AUG 1 3 1927

TWENTY-FOURTH YEAR

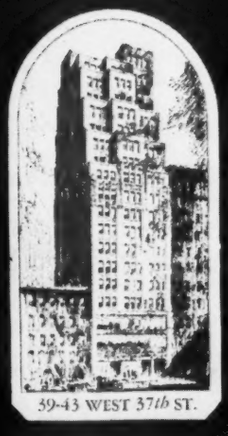
The Heating and Ventilating Magazine

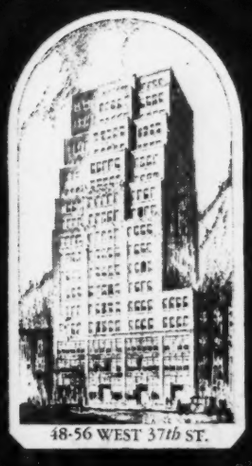
A Monthly Journal of Engineering Progress

Vol. XXIV.
No. 8.

AUGUST, 1927

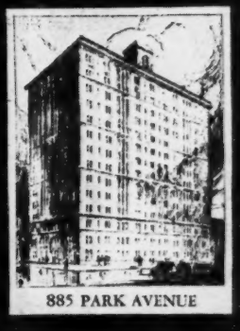
$2.00 a year.
30 cents a copy.


59-43 WEST 37th ST.


48-56 WEST 37th ST.

108-112 WEST 39th ST.

888 PARK AVENUE


885 PARK AVENUE

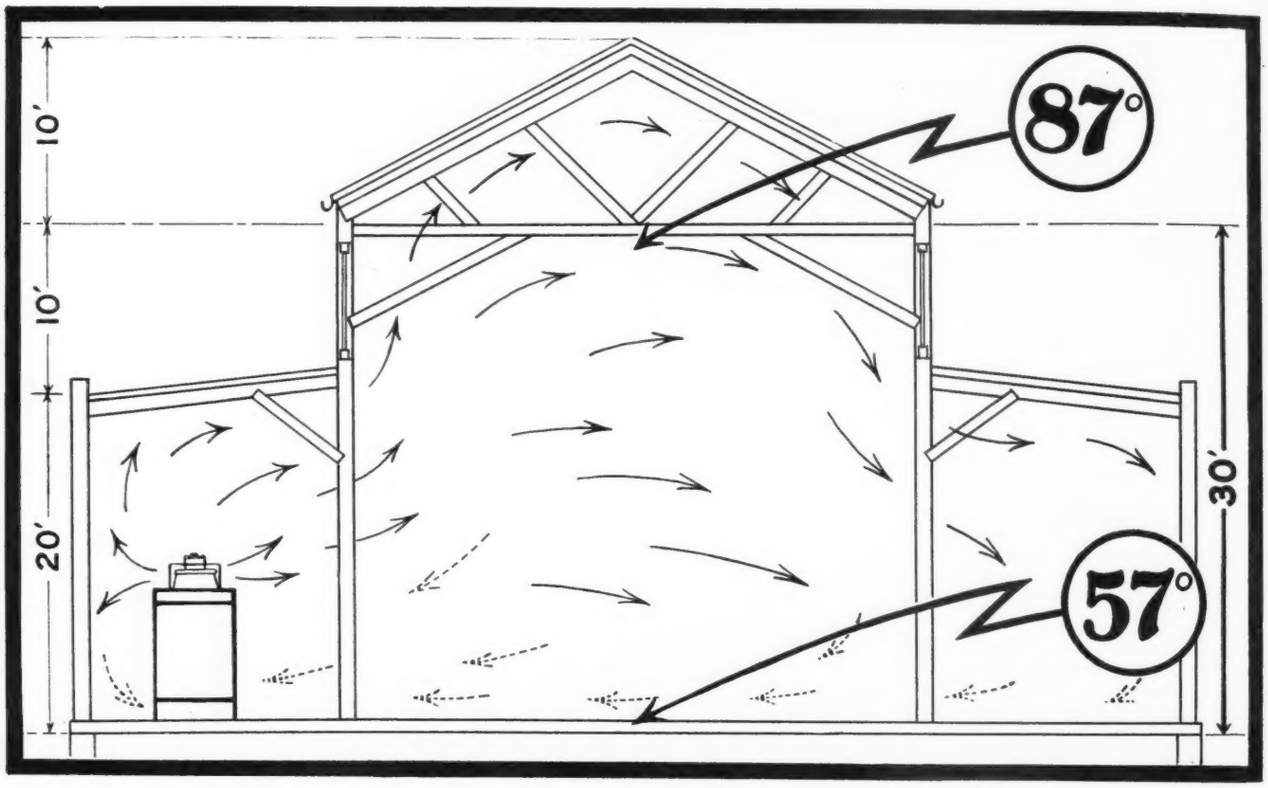
1125 PARK AVENUE

125 EAST 84th ST.

Repeat Contracts

Seven new structures erected by the same owners (Julius Tishman & Sons, Inc.) are all equipped with ILLINOIS Heating Systems.

No more convincing proof of enduring merit could be conceived than these repeat contracts by owner-builders whose experience with ILLINOIS Systems in prior buildings is one of many years standing.

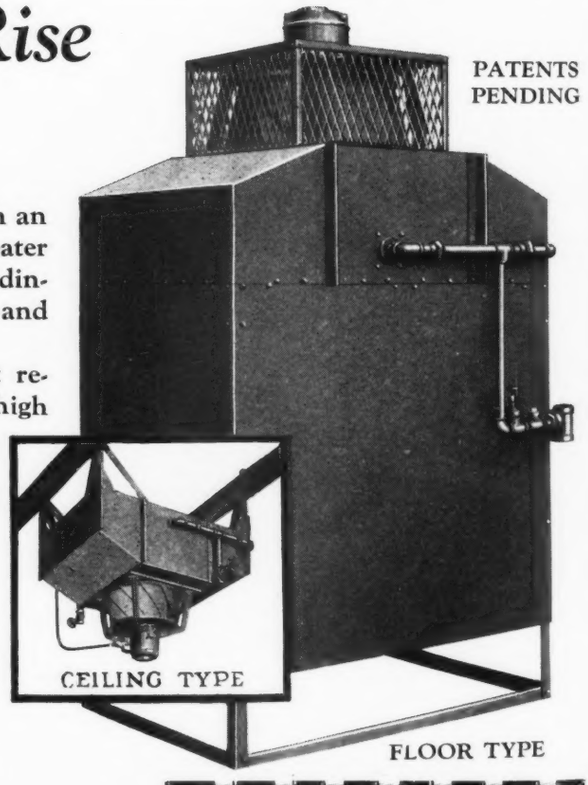


Only 1° Temperature Rise per Foot of Height

ON February 8, 1927, a temperature test conducted in an industrial plant heated by one Clarage Unit Heater revealed the ideal conditions illustrated above. With ordinary heating equipment the temperature rise is at least 2° and often more.

Clarage Unit Heaters do a good job of heating—at reduced cost. They deliver heat direct from the fan at high velocity radially in all directions (exclusive feature), keeping that heat circulating throughout the working zone. They do not permit it to rise rapidly and dissipate its useful energy at the ceiling. The result is less heat required—less fuel burned.

Heat any type of industrial building with Clarage Unit Heaters—and save substantially. Units are shipped ready to run—easily installed. Let us explain all of the advantages of this new and more efficient equipment. Clip the coupon or dictate us a letter today.



CLARAGE FAN COMPANY
KALAMAZOO, MICHIGAN BRANCHES IN 22 CITIES

Mail This Coupon

Clarage Fan Company,
Kalamazoo, Michigan.

Kindly send me your FREE Catalog 42 on Clarage Unit Heaters.

Name_____
Firm_____
Address_____

CLARAGE *New* UNIT HEATER

THE ONLY UNIT DELIVERING HEAT *DIRECT* FROM THE FAN RADIALLY IN ALL DIRECTIONS

The Heating and Ventilating Magazine

VOL. XXIV

Reg. U. S. Pat. Off.
Reg. Canadian Pat. and Copr't Off.

No. 8

Contents for August, 1927

"Responsivity" as a Factor in Heating Calculations.....*Charles D. Wolfsfeld* 55
A New Method of Figuring Based on the Rate of Heat Penetration Through Building Materials.

Checking an Oil-Fired Boiler for Combustion Volume..... 61

Notes on the Design and Testing of Automatic Roof Ventilators.....*A. J. Mack* 62
Review of Previous Tests, with Summary of the Principal Factors to Be Considered in Arranging a Test Set-Up.

Purdue's New Central Heating Plant.....*J. D. Hoffman* 64
II—Determining Steam Requirements and Sizes of Mains—Costs of Materials, Equipment and Installation.

Pipecraft 69
VII—Steam Mains in General, Dripping Mains for One-Pipe Gravity Steam Systems, Dripping Vapor Steam Mains, Dripping Vacuum Mains, Air Relief for Hot Water Mains.

New Home-Study Course in Gravity Steam and Water Heating *Ara Marcus Daniels* 73
Lesson No. 25 (continued) Chimneys.

What's Wrong with This Code?..... 79
Basis Proposed by A. S. H. & V. E. for Rating Low-Pressure Heating Boilers Is Open for Discussion.

Process Steam and Its Application.....*Morris A. Hall* 82

Applications of the Modern Expansion Joint.....*Harold L. Alt* 83
How These Devices Compare with Pipe Bends in Solving Piping Problems Both Above and Below Ground.

Heating Plants as Fixtures.....*John Simpson* 86
3. As Between Landlord and Tenant.

The Future of Coal and Its Relation to Smoke Abatement..... 88
What Science Is Doing to Eliminate Objections to the Use of This Fuel in Ever Increasing Quantity.

Health and Ventilation.....*Peter H. Bryce, M.D.* 90
4. House Lighting in Relation to Health.

Design of Lumber Dry Kilns—III..... 92

American Society of Heating and Ventilating Engineers..... 94
Society Co-Operating in Revision of Refrigeration Safety Code.
Cleveland Chapter Elects Officers.
Minnesota Chapter Elects Officers.
New Kansas City Building Code Adopts Societies' Standards.

The Business of Contracting—III..... 96

Correspondence 99
Sizing Vacuum Heating Systems.
"The Next Size Larger."

American Oil Burner Association..... 100
Live Issues Facing the Oil-Burner Industry.
Next Convention to Be Held in Chicago.
Committees Appointed for 1927-8.
Chicago Oil Burner Association Incorporated.
Oil-Burning Research at Johns Hopkins for the Oil Heating Institute.

Legal Decisions 102
Lessor's Duty to Repair Radiators Under Lease Provisions.
Contract for Installation of Heating System a Construction Contract.

Master Plumbers Take Stand on Direct Selling..... 103

Oil Burners for Large Low-Pressure Heating Plants..... 112
1. Todd.

When Oil Burners Are Sold..... 114

Present Accepted Practice in Domestic Oil Burners..... 115
31. Aladdin.

Standard Heating and Ventilating Data Sheets.....114A
No. 20B—Air Conditioning—Moisture Regain Chart.
No. 20C—Air Conditioning—How to Use Moisture Regain Chart.

Engineers' Specification Index, Page 178

Advertisers' Index, Page 186

YEARLY SUBSCRIPTION $2.00 **SINGLE COPIES, 30 CENTS**

Published monthly at 1123 Broadway, New York, by the Heating and Ventilating Magazine Co.

Entered as second-class matter, April 18, 1925, at the Post-Office at New York, N. Y., under the Act of March 3, 1879.

Copyright, 1927, by Heating and Ventilating Magazine Co.

The Progress of Heating and the Prevention of Heat Waste

Sixth of a Series

The Stove in 1744

THE stove was invented by Benjamin Franklin in 1744.

There were stoves earlier than that; but Franklin's invention brought them into general use. This invention was the first really effective advancement in heating. It brought the heating apparatus into the room and radiated heat all around: enabling people to obtain 40 to 60 per cent of the heat throughout the room; losing, however, the great balance up the stove pipe and out the chimney.

In comparison, little progress has been made in some modern minds as regards attention to present day heat loss and excess fuel consumption: for buildings continue to be erected without consideration of possible and essential heat control today. On the other hand, architects and builders—aware of the success of The Johnson System of Heat Control, include it in all of their buildings—thus automatically regulating the heat of each room correctly, night and day: and thus preventing heat waste and loss as much as 40 per cent.

JOHNSON SERVICE COMPANY
MILWAUKEE, :-: WISCONSIN

Branches in all principal cities of United States and Canada

THE ALL METAL AND DUAL THERMOSTAT SYSTEM OF CONTROL

Johnson System Of Temperature Control valves, entirely of metal, are guaranteed for 10 years, but will last a lifetime: insuring perfect operation always, no serious repairs, and dependable service forever after installation.

The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress

AUGUST, 1927

"Responsivity" as a Factor in Heating Calculations

A New Method of Figuring Based on the Rate of Heat Penetration Through Building Materials

By Charles F. Wolfsfeld

TO say that no two heating engineers will compute the same size of radiators for a given room is not exaggerating. And to say, further, that both will be absolutely correct is not so far-fetched as it would seem. Each engineer assumes a certain type and grade of construction and workmanship for the building proper; he bases his computations upon definite predetermined severe weather conditions and, lastly, presupposes certain factors of performance for the constituent parts of his heating system.

Strictly speaking, a variance from any one of these characteristics in practice will lessen the accuracy of the calculations. So far as the heating engineer is concerned, the first and last items are merely hypotheses. Even in the face of the most severe specifications and inspections, they remain a gamble.

The second item, that of climatic conditions, is chiefly a matter of investigation into records of prevailing winds and temperatures and a matter of choice by the engineer as to what constitutes a reasonable basis for heat-loss computation.

Even though all assumptions might materialize in practice, the assumed weather condition may prevail rarely, if at all, during any one year. And should it occur once a year, the engineer might boast of a one-day heating system good for, say, December 15 and on other days too large or too small. (Note: The writer will discuss the "Flexible Heating System" in a future article.)

While heating and ventilating engineering is rapidly attaining the standing of an exact science, there remains a veritable rift between the practices of the conservative designer who "plays safe" and the economical designer who prefers to keep the cost down and to take a chance on having warm weather until the guarantee period expires.

Mitigating somewhat this rift in commercial practice is the standard contract form which provides that the heating system be capable of heating the building to 70° F. in zero weather in New York City and to corresponding temperatures for other localities. This provision, however, has not always resulted in sufficient radiation in rooms on the shady sides of the building. The difficulty was met by the engineer in the usual way—the way of percentages. To correct for exposures some would add 20% to the radiation for the north wall, 15% for the west wall, 10% for east and 5% for south. Some would make these percentages 25, 20, 15 and 10 or 33, 25, 15 and 0, or 35, 25, 10 and 0. Some would use the same percentage for north and west and another for both south and east. Still others would neglect south and east. Occasionally, the exposure factor would be applied to sloping roofs and rarely to a flat roof.

Instead of applying the factors for exposure only to the respective walls, some engineers multiply the radiation for the entire room by a factor depending upon the most severe exposure for the room in question. The method of applying a factor to the radiation of the entire room is indefensible. For rooms on the top floor, where a flat roof heat loss occurs, an overall factor would apply to the roof, as well as the walls. Such a procedure might increase the roof loss computation for a north room by 35% and for a south room not at all.

APPLYING CONSTANTS TO AFFECTED AREAS

The heat loss for a flat roof being the same for the entire building, for any weather condition, this method must be stamped as inaccurate.. (See rooms marked "A" and "B" in Fig. 1.) Much more logical is the method of applying constants to the affected areas. Especially is this method correct for a blank wall (without windows, doors, etc.). Where the wall contains windows, etc., even this method might be questioned.

Assuming, for example, a wall, half of which consists of windows, the exposure being northwest, would it be reasonable to add 30% to the wall, including the glass? Off-hand, one might say, "No, there would be a relatively high infiltration loss for the windows and not for the wall." However, as has been pointed out in a previous discussion, exposure factors should not be applied to window infiltration.

There is an apparent error, nevertheless, in applying one factor to both wall and glass. It seems far-fetched to assume that the northwest wind, blowing directly on the wall, will have exactly the same effect on a 12-in. brick wall as on the glass windows.

To begin with, the surface of the wall is rough and coarse; that of the glass is smooth and polished. The action of air currents, in these cases, is common knowledge. Every surface exposed to a fluid (liquid or gas) has a film or coating of this fluid in direct contact with its face. Similar to a river, with the water at its shores at very low velocities, this film is at rest and forms an insulating stratum.

Any external influence that agitates this film, disrupts the blanket formation, thereby minimizing the insulating effect. The degree to which this resistance to heat flow becomes reduced, depends upon the intensity and direction of wind (or fluid, etc.) and the character of surface. Other things being equal, the more intense wind and the smoother surface will yield (in the case of the wall and window) the lower effective surface temperature.

CONDUCTIVITY AS AFFECTED BY THICKNESS

The second point of difference in behavior of the wall and glass is the conductivity of the materials, coupled with their respective thicknesses. While the conductivity of glass may be half the conductivity of brickwork, the fact that the glass window is so much thinner than the wall, explains why so much more heat is transmitted through windows than through walls. And this wide difference in behavior between various materials and types of building construction suggests a question that challenges our method of applying one exposure constant to an entire wall.

Should a heavy wall, which requires hours to transmit a change in temperature from one surface to the other, be treated with the same exposure correction as single-thick glass which requires only a few seconds? In Harding and Willard (Vol. 1) it is shown that a 15-mile wind adds 47% to the "still-air" heat transmission through window glass, whereas this increase for a 12-in. brick wall is only 14%.

To amplify upon this phase of exposure, assume a 24-in. concrete wall having windows for half its area, this wall being the only exposed wall of a room facing north. The room in question is occupied from 9 A.M. to 5 P.M. For a south wind prevailing say from 10 A.M. to 2 P.M., the total duration would be 4 hours. It has been found by

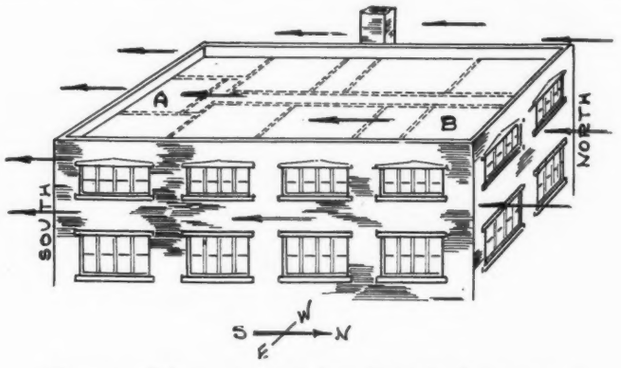


Fig. 1. Effect of Applying Overall Constants as Exposure Correction.

Note that the unit roof losses for south and north rooms are identical, showing the inaccuracy of this method. Note also that roof loss for all rooms should be based on the same probable severe wind.

test that a temperature change on one side of a 24-in. concrete wall is not effective on the opposite side until 7 hours have elapsed. Window glass requiring only a few seconds for this effect is practically instantaneous in its response.

In the case of the wall, the inside face would not be affected until 5 P.M., which is closing time. In the case of the glass, the heat loss would suffer a very decided increase throughout the entire duration of the wind. The usual calculation would allow a 33% (or similar) increase for the wall, as well as the glass. In the case just cited, it would seem more satisfactory to neglect the wall and add 50% or more to the glass. But who shall say what percentage to add and when to add it? What for heavy walls? Thin walls? Single and double-thick glass?

APPLYING HEAT-FLOW LAWS TO EXPOSURE CONSTANTS

There are a few laws applying to the flow of heat that seem to point the way:

1. The rate of heat flow is proportional to the thermal conductivity, the temperatures, thicknesses and areas being the same.
2. The time required for two points in the same or similar walls to acquire the same temperature varies as the square of the distances from the faces of the respective walls. This is known as the "Law of Times."

The first law has to do with type of material only. The conductivity of brickwork is approximately 4, and that of glass approximately 2. That

is, brickwork transmits heat more readily than glass *for the same thickness.* In other words, a sheet of brickwork as thin as window glass (1/12 in.) would transmit heat twice as fast as glass.

To illustrate the significance of the second law assume a 24-in. concrete wall of zero temperature throughout.

Assume, further, that the temperature of both faces of the wall suddenly is raised to and maintained at 70° F. After about 1¾ hours the surface temperature of 70° will have penetrated to a depth of 2 in. The time required for this temperature to penetrate 4 in. or twice the depth will be $(2)^2 \times 1.75$, or 7 hours, for 6 in., or three times the depth, $(3)^2 \times 1.75$, or 15.75 hours (16.00 by actual calculation).

As shown in the illustration Fig. 2, the time increases very rapidly as the depth increases, until the maximum time of 64 hours is reached, at which time the wall will have reached a temperature of 70° F. throughout.

DEGREE OF HEAT PENETRATION EXPRESSED AS "RESPONSIVITY."

To suit the purpose of this discussion, this law may be stated as follows:

The rate of heat penetration at any point in a wall varies inversely as the square of the distance of that point from the source of heat. Or, two walls of the same material would "respond" to a temperature effect in the inverse ratio of the squares of their thicknesses. A 4-in. brick wall, therefore, would respond to a temperature change four times as fast as an 8-in. brick wall.

$$\frac{1}{(4)^2} = \frac{1}{16}$$

$$\frac{1}{(8)^2} = \frac{1}{64}$$

$$\frac{1}{16} = 4 \text{ times } \frac{1}{64}$$

The term "responsivity" in line with conductivity, emissivity, diffusivity, etc., has suggested itself to the author as aptly qualifying this characteristic for our special need.

The responsivity of a 4-in. brick wall accordingly would be four times the responsivity of an 8-in. brick wall. In order to permit comparison between responsivities of walls of different types, we have only to incorporate the corresponding conductivities. Therefore, we may define responsivity as the conductivity divided by the square of the thickness

$$R = C \div t^2$$

The responsivity of a 12-in. brick wall would be $5 \div (12)^2$ or 0.0347, while that of window glass would be $2 \div (0.085)^2$ or 276.8. This gives the responsivity of glass (single thick.) as 8020 times that of 12-in. brick wall.

A wind that would work its effect through glass in one second would require 7980 seconds (2.22 hours) to penetrate the 12-in. brick wall. Assuming 1 second for glass as a basis, the responsivities of other forms of construction can be expressed in terms of time. This has been done for various forms of building construction as shown in the table on Page 58.

Where the construction is of a composite type, the responsivity for the whole was obtained by use of the following formula:

$$R = \frac{(t_1 \times C_1) + (t_2 \times C_2) + (t_3 \times C_3) + \ldots.}{(t_1 + t_2 + t_3 + \ldots.)^3}$$

In this expression t_1, t_2, t_3, etc., represent the thickness of the respective layers of construction and C_1, C_2, C_3, etc., their corresponding conductivities.

APPLICATION OF "RESPONSIVITY" FORMULA

To illustrate the application of this formula and also to prove its correctness, assume three layers

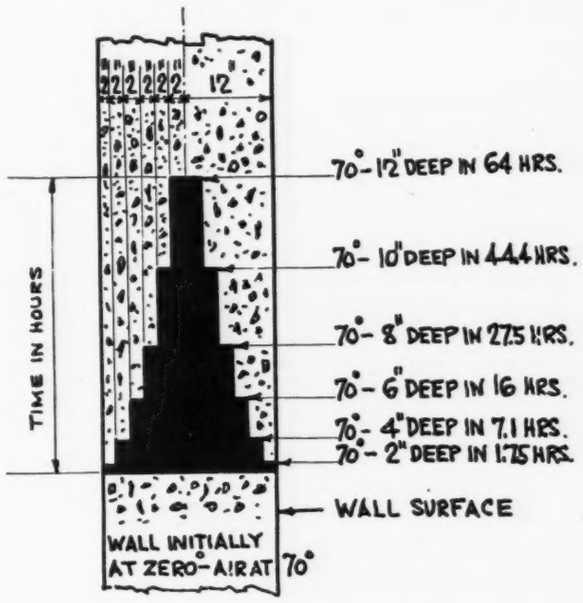

12
70°-12" DEEP IN 64 HRS.
70°-10" DEEP IN 44.4 HRS.
70°-8" DEEP IN 27.5 HRS.
70°-6" DEEP IN 16 HRS.
70°-4" DEEP IN 7.1 HRS.
70°-2" DEEP IN 1.75 HRS.
TIME IN HOURS
WALL SURFACE
WALL INITIALLY AT ZERO°-AIR AT 70°

Fig. 2. "The Law of Times"

The time required for any point in the wall to reach 70° varies as the square of the distance from the surface.

of concrete, 2 in., 3 in. and 7 in. thick, respectively. The responsivity for this combination would be:

$$R = \frac{(2 \times 8) + (3 \times 8) + (7 \times 8)}{(2 + 3 + 7)^3} = 0.0555$$

which is the same as that for a 12-in. wall, namely,

$$\frac{8}{(12)^2} \text{ or } 0.0555$$

Air spaces have been treated as solids with a conductivity of 0.156 (50° F.) per square foot per inch of thickness.

Air, of course, is a difficult matter to treat as it exists in forms of construction. Air at rest is

commonly considered a poor conductor. In order to act as such in building construction it must be divided up into very small volumes or cells. As the size of these air spaces is increased, convection currents are set up, resulting in an increased flow of heat.

In the absence of exact data, the method of treating air as a slab might be considered approximately correct, provided its thickness does not exceed 2 in.

The responsivity of a 13-in. brick wall, with ½-in. of plaster on one face, would be computed as follows:

$$R = \frac{(13 \times 5) + (0.5 \times 8)}{(13 + 0.5)^3} = 0.028$$

Incorporating a 0.4-in. air space between wall and plaster, the responsivity becomes:

$$R = \frac{(13 \times 5) + (0.4 \times .156) + (0.5 \times 8)}{(13 \times 0.4 \times 0.5)^3} = 0.0257$$

In forms of construction involving hollow tile, the responsivities were obtained by assuming an average thickness for the solid portions of tile and

TABLE OF RESPONSIVITIES

FOR VARIOUS TYPES OF CONSTRUCTION

CONSTRUCTION	THICKNESS INCHES	RESPONSIVITY	RESPONSIVITY TIME-HOURS (GLASS-1 SEC.)
PLAIN BRICK WALL C=5	4	.3120	0.246
	9	.0617	1.240
	13	.0296	2.600
	18	.0154	5.000
	24	.0087	8.880
BRICK FURRED ¾" PLAST. .4" AIR SPACE C-PLASTER=8	9	.0488	1.570
	13	.0251	3.070
	18	.0136	5.650
	24	.0079	9.750
WOOD WALL OR FLOOR SOLID WOOD	7/8	.1490	0.516
	1¾	.0880	0.875
	2⅝	.0540	1.420
HOLLOW TILE ½" PLASTER BOTH SIDES	2	1.8400	0.042
	4	.8030	0.096
	6	.5420	0.142
GLASS .085" C=2	SINGLE	276.8	ONE SECOND
	DOUBLE	69.3	4 SEC'S.

CONSTRUCTION	THICKNESS INCHES	RESPONSIVITY	RESPONSIVITY TIME-HOURS (GLASS-1 SEC.)
CONCRETE C=8	3	.8900	0.086
	4	.5000	0.154
	5	.3200	0.240
	6	.2220	0.347
	8	.1250	0.615
	12	.0555	1.380
	16	.0312	2.460
	18	.0247	3.120
	20	.0200	3.850
	24	.0139	5.540
CONCRETE ROOF ⅛" SLAG-C=0.4	3	.7880	0.097
	4	.4550	0.169
	5	.2790	0.276
4" BRICK & HOLLOW TILE ½" PL. ½" MORTAR C=8	TILE 2	.1240	0.620
	4	.1180	0.652
	6	.1000	0.770
9" BRICK & HOLLOW TILE	2	.0389	1.980
	4	.0378	2.030
	6	.0345	2.230
13" BRICK & HOLLOW TILE	2	.0212	3.630
	4	.0208	3.700
	6	.0194	3.970
18" BRICK & HOLLOW TILE	2	.0120	6.410
	4	.0119	6.470
	6	.0112	6.880
24" BRICK & HOLLOW TILE	2	.0072	10.700
	4	.0071	10.850
	6	.0068	11.300

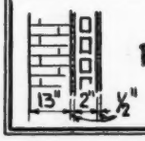
NOTES:—

HOLLOW TILE REDUCED TO AVERAGE THICKNESS, AND CONDUCTIVITY PER INCH, AS FOLLOWS:—

TILE THICK'S.	AVERAGE THICKNESS	CONDUCT'Y PER INCH
2"	1.16"	9.15
4"	1.49"	2.98
6"	1.83"	2.35

AIR (NOT OVER 2" THICKNESS) C=0.156 PER IN.

EXAMPLE:- RESPONSIVITY $= \frac{(t_1 \times C_1) + (t_2 \times C_2) + \cdots}{(t_1 + t_2 + \cdots)^3}$



$R = \frac{13 \times .5 + .5 \times 8 + 1.16 \times 9.15 + .5 \times 8}{(13 + .5 + 1.16 + .5)^3} = .0212$

RESPONSIVITY TIME-ASSUMING GLASS AS 1-SECOND

$= \frac{276.8 \times 1}{.0212 \times 3600} = 3.630$ HOURS

C.F.W.

a corresponding conductivity per inch of such average thickness.

APPLICATION OF "RESPONSIVITY" TO HEAT-LOSS CALCULATIONS

Leading up to the application of responsivity to heat-loss calculations, it is interesting to note the behavior of an outside wall under changing conditions of wind and temperature. Assume a 24-in. concrete wall. Outdoor temperature at 9 A.M. is 35° F. and no wind is blowing. The building in question has been unoccupied for several days and the entire wall cooled to a temperature of 35° F. At 10 o'clock a 20-mile wind blows upon this wall. The effective temperature for this wind at 35° is 20° (see chart on Page 60). After this wind has prevailed for about two hours, the outer side of the wall has been cooled to a temperature of 20° for a depth of say 1½-in. At 12 o'clock the wind ceases and the temperature rises to 40° F. At this point, we have an atmosphere on the outside which is warmer than the surface of the wall. *Instead of the wall being cooled as before, the air now heats the wall!*

Even though heat be turned on at 8 o'clock within the room in question, due to the thickness of the wall, the higher inside temperature would not have penetrated sufficiently to affect this action at the outer face.

While we are in the habit of looking upon an outside wall as being cooled by low outside temperatures, this example illustrates how the outer face of a heavy wall might take on heat from the outer air after a cold wind has subsided.

This heat is then stored until a lower effective temperature is again created by wind or a colder atmosphere. This phenomenon of a wall storing up heat and giving it back again from and to the outer air has been characterized by some engineers as a "fly-wheel action."

Among the many conditions assumed in ordinary heating calculations is the fact that the temperature drops at a uniform rate from the warmer to the colder face of a wall, roof, etc., regardless of the thickness of same. This assumption may be fairly correct for thin walls of high conductivity, that is, for walls of high responsivity. For walls of low responsivity, however, this assumption rarely holds. A uniform drop in temperature from one face of a wall of low responsivity would occur after many hours, if not days, of constant effective temperatures at both faces.

In practice, the temperatures would be more like those shown in Fig. 3. The temperatures at points A and E are due to conditions obtaining for the moment. Temperatures at points B and D may be due to conditions that have obtained for the preceding 16 hours, and the temperature at the center may be the result of conditions that have obtained for the previous 64 hours.

We may say, therefore, that the temperature at the center of this wall may be the result of the "average" effective temperatures for the 64 hours previous. This leads to the idea that walls of high responsivity should be computed on the basis of probable severe conditions of *short duration,* whereas walls of low responsivities should be computed on a basis of probable severe average condition of *long duration.* This applies to *inside* conditions, as well as to those of the *outside.*

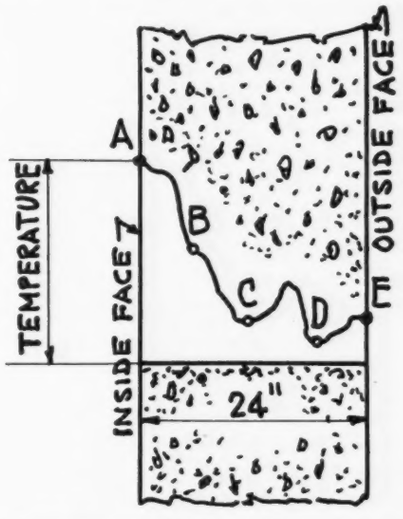


Fig. 3. Temperature Gradient Through Wall of Low Conductivity

EXAMPLE OF APPLICATION OF "RESPONSIVITY"

To illustrate the application of responsivity to a practical case, assume a room 20 ft. x 30 ft. x 12 ft. on the top floor of a building with the 30-ft. wall exposed to the north. The outside wall is 13-in. brick, plastered, and contains four wood windows, each 4 ft. wide and 8 ft. high. The building is heated to 70° F. Examination of weather records for the locality in question reveals the following data for a representative severe winter.

Average of ten lowest "still-air" (no wind) temperatures, 12° F.

Average of ten lowest effective temperatures due to winds of *one hour duration,* 15° F.

Average of ten lowest effective temperatures due to winds of *two hours duration,* 0° F.

Average of ten lowest effective temperatures due to winds of *three hours duration,* 8° F.

For convenience, the various quantities, factors, etc., of interest in this calculation have been arranged in tabular form as shown on Page 61.

Beginning with the wall, we find that its responsivity time is 3.07 hours (Column 4 in table). That means that the greatest cooling effect for this wall will be caused by the most severe combination of effective temperatures that may prevail for any *three consecutive hours.* This condition may be effected by one extremely severe hour or by two or three milder hours. The test for this condition may be made as follows:

Multiply the difference in effective temperatures between opposite faces of the wall for each weather condition by its respective duration in hours. The condition yielding the highest product is the one upon which computations should be based. The

products for the three winds assumed in these cases are as follows:

(1) Effective Wind Temperatures Deg. F.	(2) Duration Hours	(3) Difference in Eff. Temps.—room at 70° F.	(4) Degree—Hours (Col. 2 x Col. 3)
—15	1	85	85
0	2	70	140
8	3	62	186

As shown in these products, the greatest number of degree-hours that would obtain for any one of the winds assumed is 186, this being for the three-hour wind, of 8° effective temperature.

This condition, therefore, upon which computations for the wall were based. Computations for the winds and roof were similarly made, all steps being clearly shown in table.

Column 13 contains quantities derived by the usual 0°-70° method, with 33% added for north.

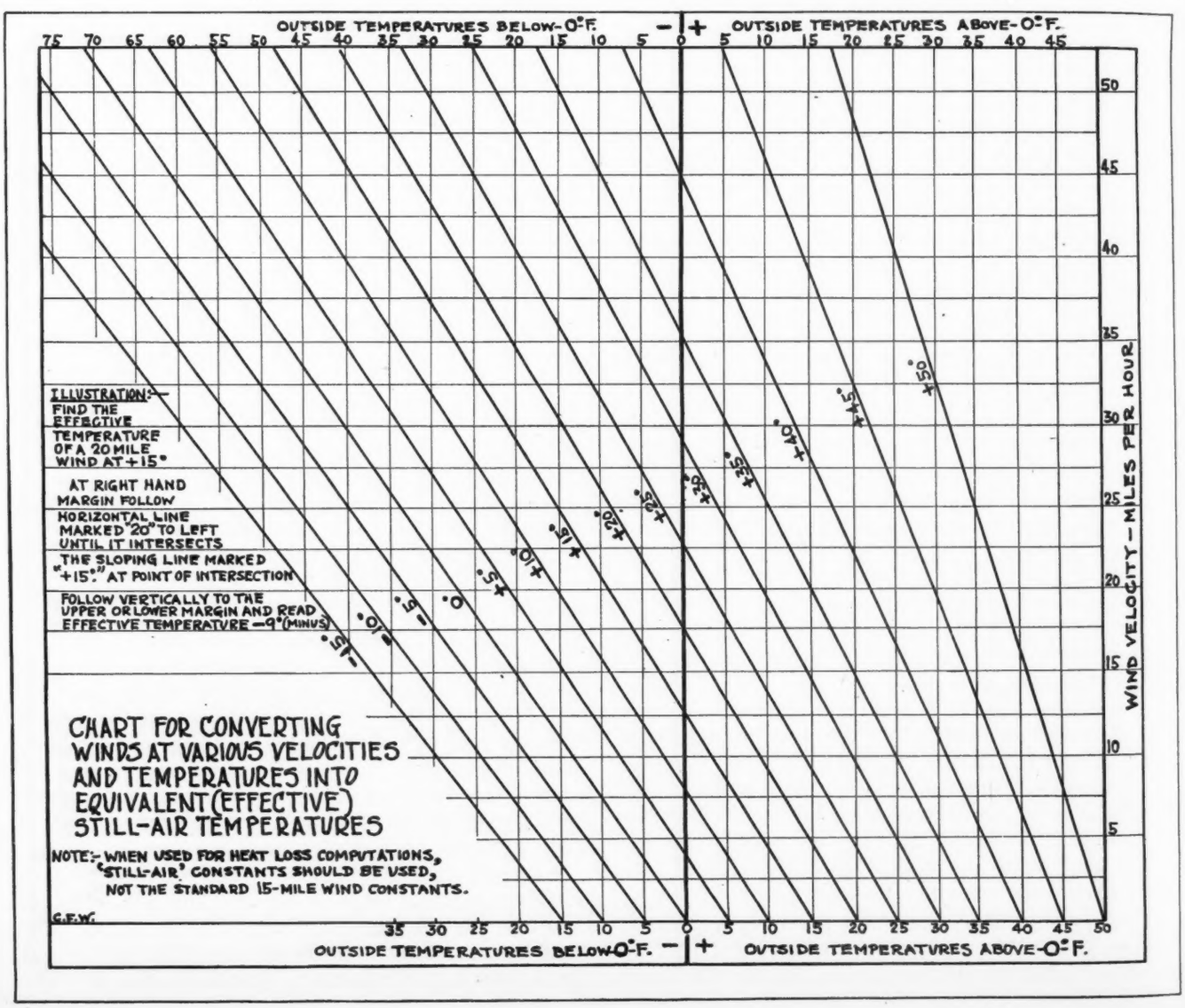
For the weather conditions assumed, the standard method appears to give higher results than the method of responsivity and effective temperatures. In connection with this point of difference, it is interesting to note that the standard coefficients of transmission allow for a 15-mile wind. And when one considers a 15-mile wind at a temperature of 0° F. (—20° effective temperature) a very severe condition is being contemplated.

The roof heat loss computations in both cases agree very closely. It seems that the higher temperature difference in one case offsets the higher coefficient of transmission in the other. It is grossly approximate to assume 70° F. for the ceiling temperature of a room of any appreciable height, that is, where the room temperature is 70° F. Notwithstanding the higher values, standard practice does not result in oversize radiation.

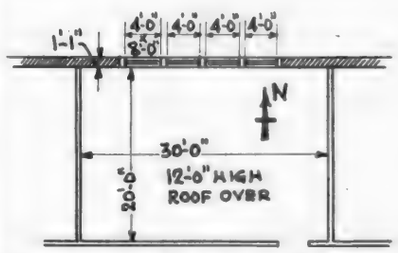
INFILTRATION AND HEAT ABSORPTION OF INTERIORS

There are a few computations that remain to be made, in the method outlined in this discussion, which may result in somewhat higher radiation figures than those of the standard method. These computations are as follows:

1. Infiltration,
   (a) Window crevices, etc.
   (b) Walls, etc.
2. Heat absorption of interior of cold buildings,
   (a) Partitions, floors, etc.
   (b) Enclosed air.


OUTSIDE TEMPERATURES BELOW-0°F.
OUTSIDE TEMPERATURES ABOVE-0°F.
WIND VELOCITY - MILES PER HOUR
ILLUSTRATION:— FIND THE EFFECTIVE TEMPERATURE OF A 20 MILE WIND AT +15°
AT RIGHT HAND MARGIN FOLLOW HORIZONTAL LINE MARKED "20" TO LEFT UNTIL IT INTERSECTS THE SLOPING LINE MARKED "+15°" AT POINT OF INTERSECTION
FOLLOW VERTICALLY TO THE UPPER OR LOWER MARGIN AND READ EFFECTIVE TEMPERATURE —9° (MINUS)
CHART FOR CONVERTING WINDS AT VARIOUS VELOCITIES AND TEMPERATURES INTO EQUIVALENT (EFFECTIVE) STILL-AIR TEMPERATURES
NOTE:- WHEN USED FOR HEAT LOSS COMPUTATIONS, 'STILL-AIR' CONSTANTS SHOULD BE USED, NOT THE STANDARD 15-MILE WIND CONSTANTS.
C.E.W.

1	2	3	4	5	6	7	8	9	10	11	12	13
ITEM	AREA SQ. FT.	RESPONSIVITY CONSTANT	RESPONSIVITY TIME-HRS (GLASS-1 SEC)	COEFFICIENT OF TRANSMISSION STILL AIR	COEFFICIENT OF TRANSMISSION 15-MILE WIND	EFFECTIVE TEMPERATURE INSIDE	EFFECTIVE TEMPERATURE OUTSIDE	DIFFERENCE IN EFF. TEMP'S.	HEAT LOSS FACTOR	HEAT LOSS B.T.U. PER HR.	RADIATION REQUIRED	RAD'N. STANDARD 0°-70° +33% FOR NTH.
								(7-8)	(5×9)	(2×10)	(11÷240)	
13-IN. BRICK WALL, PLAST'D	232	.0251	3.07	.169	.185	70	+8	62	10.48	2,340	9.75	16.6
DOUBLE HUNG WOOD WINDOW	128	GLASS 276.8	ONE SECOND	.75	1.126	70	−15	85	63.75	8,160	34.0	56.0
5" CONC. ROOF 1/8" SLAG	600	.279	.276	.404	.514	75	−15	90	36.36	21,816	91.0	90.0
						INFILTRATION-112 FT. CREVISE @ .3					33.6	33.6
						TOTAL RADIATION					164.75	196.2



SPECIMEN CALCULATION USING RESPONSIVITIES AND EFFECTIVE TEMPERATURES

NOTE- CALCULATION FOR 24-HOUR OPERATION
NO ALLOWANCE INCLUDED FOR INTERMITTENT HEATING

C.F.W.

As pointed out in a previous discussion, we may reduce heat loss constants when infiltration research has established the actual air leakage through walls, etc.

Computations for heat absorption are usually made under the designation "intermittent heating" simply by adding a certain predetermined percentage (10%-50%) to the radiation, depending upon conditions and the judgment of the engineer.

This important phase of heating calculations, which has barely been scanned up to the present time, will be the subject of a later discussion.

Checking an Oil-Fired Boiler for Combustion Volume

TO determine if a given boiler has a combustion volume sufficient to insure complete combustion of the maximum oil-delivery from any certain oil burner, the following simple computation can be carried out:

Multiply the square feet of standing radiation in the house by the radiation factor per square foot, 240 for steam or 150 for water, which will give the net B. T. U. requirements per hour. Add 60% to this for piping allowance and for peak-load demand. This, then, will be the gross demand upon the boiler.

Then divide this by the estimated efficiency of the boiler, which may vary between 60% for a small, or old-type installation, and 80% for the larger sizes and more modern types. This will result in the gross input to the boiler necessary to handle the peak load on the system.

Divide this by the number of B. T. U. per pound of fuel to be used, and the quotient will be the number of pounds of oil that must be burned, per hour, to attain desired maximum results. Dividing this by 1.75 will give the necessary number of cubic feet for proper combustion of this fuel. Then see if the boiler provides that space.

Taking a concrete example will show how this procedure works out: A home has 720 sq. ft. of standing steam radiation. As the radiation is based on the emission of 240 B. T. U. per sq. ft. per hr., the normal net load on the boiler will be:

$$720 \times 240 \text{ B.T.U.} = 172{,}800 \text{ B.T.U.}$$

To allow for loss from piping and for peak demand, we divide by 0.6:

$$172{,}000 \text{ B.T.U.} \div 0.6 = 288{,}000 \text{ B.T.U.}$$

which represents the maximum demand upon the boiler.

Now the house is heated with a steel tubular boiler, properly rated for the load, so we can assume an efficiency of 80%. (It must be noted that this is not the "average" or "seasonal" efficiency upon which oil consumption for the year may be based, but the efficiency that the boiler will show when handling the above load; it is almost up to the maximum ability of the boiler.)

Then we will have, for the necessary boiler input

$$288{,}000 \text{ B.T.U.} \div 0.8 = 360{,}000 \text{ B.T.U.}$$

and, if we assume a 32° oil containing 19,500 B.T.U. per pound, we must fire

$$360{,}000 \div 19{,}500 = 18 \text{ lbs., approximately.}$$

As we have agreed to allow 1 cu. ft. of combustion volume per 1.75 lbs. of fuel fired, we must have available 10.3 cu. ft.

Notes on the Design and Testing of Automatic Roof Ventilators

Review of Previous Tests, with Summary of the Principal Factors to Be Considered in Arranging a Test Set-Up

By A. J. Mack

Associate Professor, Department of Mechanical Engineering, Kansas State Agricultural College.

PROFESSOR Mack's studies in the field of automatic roof ventilators, covering a period of many years, qualifies him, to an exceptional degree, to speak with authority on the subject. His present article may be considered as supplementary to that of George D. Beals on "A Proposed Set-Up for Testing Automatic Roof Ventilators," which appeared in THE HEATING AND VENTILATING MAGAZINE *for May,* 1927.

AUTOMATIC roof ventilators commonly have been used for the removal of gases from enclosures. In very recent years, however, their use has increased due to publicity and improved design, with increased effectiveness. They are especially desirable as no costly mechanical power is necessary. Their effectiveness, however, is dependent upon the action of the wind and upon the difference in temperature between the outside and inside of the enclosure ventilated.

The requirements of a successful automatic ventilator are fourfold:

1. It should be rugged enough to withstand the rather exceptional conditions to which it is exposed.
2. As a protecting device it should provide a positive means of preventing the entrance of rain or snow.
3. It should be constructed so that the gases readily can pass out when no wind is blowing and not be affected by down drafts when winds prevail.
4. For maximum capacity it must be designed to take advantage of the wind in producing additional draft.

Commercial ventilators are made in the stationary and revolving types. In some designs, in both types, an attempt has been made to use the wind to better advantage in producing drafts. In some cases the attempt has been successful and in others not.

The design of automatic roof ventilators has not been given the scientific study which it deserves. Highly-colored advertising, rather than actual results, has done much to make certain ventilators popular. This has led to ingenious copying to get around patent rights, rather than to secure more scientific design.

A rather careful study of results of tests, conducted by the Engineering Experiment Station of the Kansas State Agricultural College on a large number of ventilators, indicates that the greatest factors contributing to the effectiveness of automatic ventilators are:

1. Large projected area exposed to the wind. A large area produced a larger low-pressure area and a better exhaust.
2. Ample area of exit passages. The area for the passage of the air leaving the ventilator should be at least as large as the cross-sectional area of the inlet pipe. In the case of stationary types of ventilators it should be larger, as most of the gases must pass out on the leeward side when the wind is blowing.
3. Preventing the entrance of wind. Air which enters the ventilator must be exhausted, and, unless provision is made for the removal of the additional air or prevention of its entrance, the capacity of the ventilator proportionately is decreased.
4. The straightness of the path of egress of the air. Abrupt turns in the passage of the air introduce friction. The path of the outgoing air should be as straight as possible. If turns are necessary, they should be smooth and well-rounded.
5. The freedom of obstructions in the path of egress. The effectiveness of a ventilator may be materially lowered by obstructions. Consequently, they should be eliminated to the largest possible extent.
6. Making use of the wind working as an ejector. Any provision whereby the vacuum created by the wind is increased or made more effective will produce added ventilator effectiveness.
7. The use of the wind as a source of power for driving exhaust fans. This is the principle involved in a special type sometimes called air turbines.

SPECIAL TESTS ON SIPHONING VENTILATORS

A special investigation was made on those type of ventilators in which special attempts were made to use the wind to better advantage. These classes of ventilators are sometimes known as siphoning ventilators.

Tests were made on four stationary siphoning ventilators and on two rotary siphoning ventilators.

One series of tests on the stationary types was conducted with the siphons all open, another with the siphons all closed, and still another with the siphons closed on the windward side only.

Three of the four ventilators gave better results with siphons open than closed. One was more effective with siphons closed, while all four were more effective with siphons on windward side only open.

This would indicate that the siphons are of value as additional egress areas, rather than as suction

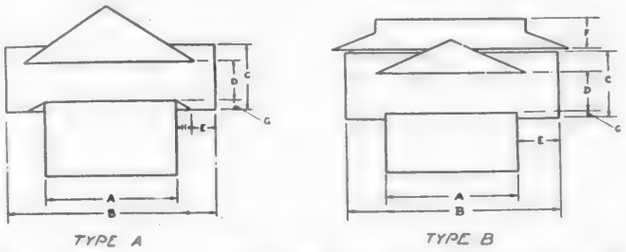


Fig. 1. Types of Automatic Ventilators in Which the Projection of the Exhaust Pipe Into the Head, as Indicated by G, Should Be a Minimum for Best Results

producers. The siphons, in some cases, serve to increase the projected area and thus have some value.

Tests were conducted on two rotary siphoning ventilators to determine the value, if any, of the siphons. In both cases better results were obtained with the siphons open than when closed, thus indicating that the siphons were of some advantage. The advantage was much more pronounced at the higher wind velocities.

Contrary to general belief, wind velocities in the Middle West are not high. The average wind velocity in Kansas and surrounding States is only nine to eleven miles per hour. This would tend to make unnecessary those ventilators of a design which requires an exceptionally high wind velocity to produce high effectiveness.

Making especial use of the wind through siphons or special ducts is secondary in ventilator design to large projected areas, ample and unobstructed egress area and straightness of path of egress.

A study of the results of tests on plain stationary ventilators showed that, in all cases where the ventilator pipe extended only a short distance, G in Fig. 1, above the band, the effectiveness was better than in those in which the pipe extension was a greater distance above the bottom of the protecting band.

Table I gives results of tests on two ventilators in which the extension of the ventilator pipe above the bottom of the protecting band was varied.

This is only another proof of the gain in effectiveness to be expected by a straighter path of egress for the air.

SUGGESTIONS ON THE TESTING OF AUTOMATIC ROOF VENTILATORS

After a design has been completed the question of effectiveness must be settled by comparative tests. Many tests by many institutions have been made and except in a comparative way results differ. Fig. 2 represents a layout of equipment used by the Kansas State Agricultural College in the testing of 10 in. ventilators.

In THE HEATING AND VENTILATING MAGAZINE for May, 1927, George D. Beals has an article on

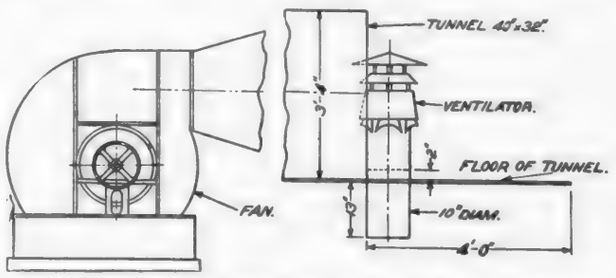


Fig. 2. Set-Up of Equipment Showing How Automatic Ventilators Were Tested at the Kansas State Agricultural College

"A Proposed Set-up for Testing Automatic Roof Ventilators." In general the two plans agree and yet the results obtained no doubt would differ very materially. There are too many variables to contend with.

Before any uniformly-recognized results can be obtained some recognized standard method of test must be adopted. Mr. Beals, in his article, has made many good suggestions as to size and operating conditions for the testing of ventilators. One criticism which might be offered would be the

(*Continued on Page 72*)

TABLE I—EFFECT OF VARYING EXTENSION OF VENTILATOR PIPE ABOVE THE BOTTOM OF BAND

Velocity of wind in miles per hour	Velocity induced through ventilator pipe, in feet per minute.				
	22 in. storm band			4¼ in. storm band	
	Extension of ventilator pipe above bottom of band			Extension of ventilator pipe above bottom of band	
	1½ in.	4½ in.	8½ in.	0 in.	1¾ in.
5	275	266	260	225	185
7	385	375	362	307	251
9	487	474	454	380	308

Airplane View of Principal Buildings, Purdue University

Purdue's New Central Heating Plant

II—Determining Steam Requirements and Sizes of Mains—Costs of Materials, Equipment and Installation

By J. D. Hoffman

Head of the Department of Practical Mechanics, Purdue University

THE grouping of the present and proposed buildings seems to suggest certain definite flow lines. This was shown in Fig. 1 (Part I). The 45° turn at X is made to avoid a turn in the railroad spur and the main campus drive.

Buildings in section G H M N, which were shown in Fig. 2 (Part I), are now complete except for a few contemplated changes and additions. Section A B is approximately 60% developed. There is as yet no steam delivered beyond G, although there are certain stock-judging and other buildings beyond Y that eventually will be taken on. There is also no steam requirement as yet along line D E F other than the Ross-Ade Bowl beyond F which will be connected later, and (20) which now is connected to line D M temporarily. Plans now considered final seem to look forward to a rather rapid development along the line D E F.

STEAM REQUIREMENTS OF THE GROUPS

All radiation marked on Fig. 1, is equivalent direct radiation, not including connecting pipes. To obtain this the average ratio of the heating value of indirect surface to direct surface is approximately 5 to 1. In all buildings not now completed or under construction, the radiation had to be assumed. These values will, of course, eventually change, but probably not greatly.

In estimating steam heating requirements at the power plant, 0.3 lb. of steam (live or exhaust) was taken as the condensation equivalent of 1 sq. ft. of direct radiation in the district, and this was increased 10% for piping connections within the buildings. The steam rate, therefore, becomes approximately 1/3 lb. per sq. ft. of equivalent radiation.

Steam is generated at 200 lbs. gage pressure and is reduced to 150 lbs. gage at station 13 (in the power plant). It is carried from station (13) at 150 lbs. through pipes so sized as to deliver to station L at 75 lbs. pressure at extreme service) through two 6-in. high-pressure lines. From L one of these 6-in. lines continues as a booster line to A 14, supplying steam for the buildings on the line A B, with especial reference to the greenhouses A 14. The other 6-in. line will run from L to the farm buildings beyond Y as a booster line.

The first of these two high-pressure lines will be in almost continuous use, the second will lie idle most of the non-heating season. Each line may be used to deliver booster steam, at L, into the two branch heating mains A B and L G Y, and into the end of the 12-in. low-pressure heating main. Each line is also connected into the far end of the low-pressure heating main on that run.

The 12-in. heating main is planned to carry steam from (13) at 7½ lbs. gage to L at 4 lbs. gage. All heating lines leaving L and all other heating groups are to operate under similar pressure.

Exhaust steam will be used over the district as far as possible. For example, if, on mild days, there should be more than enough exhaust steam to take care of the nearby groups, this steam may be carried beyond station L and make-up steam from the high-pressure lines added through three 2-in. Boylston reducing-valves at this point. These valves are set at 4 lbs., 3½ lbs., and 3 lbs.

Note:—The first section of this article outlined the problem involved in designing a steam heating and power distributing system for Purdue University. The campus covers 1000 acres and the gross heating load will be 700,000 sq. ft. of radiation.

Served by Central Heating System

Exhaust steam will not be used beyond station F on the north or beyond station Y on the west.

Line D E F will be arranged quite similarly to line D L, with one large low-pressure heating main and two high-pressure lines, arranged that each one may boost at F, after the same plan as that shown by sketch at L.

The solid lines, Fig. 2, represent the low-pressure heating lines and the two broken lines represent the high-pressure *through lines* of the system.

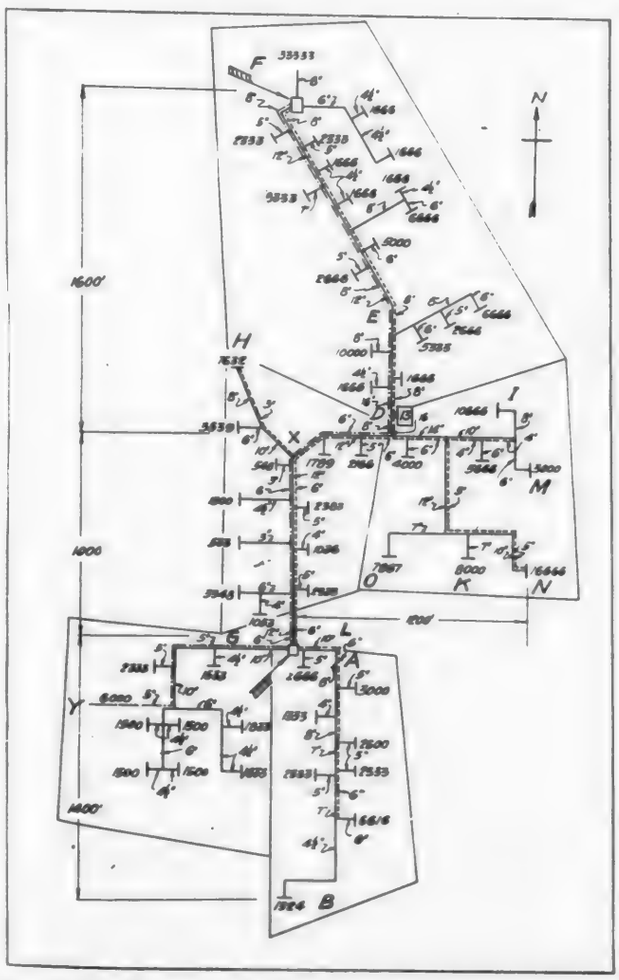


Fig. 2. Pipe Sizes and Maximum Hourly Steam Demand of Purdue University's Central Heating System
(Reproduced for convenience in reference from Part I, July issue)

SIZES OF STEAM FLOW MAINS

The principal pipe sizes were obtained by the use of the well-known Babcock formula.

Application 1. For the two groups, A B and L G Y, south of distributing station L, the through line will carry 41641 lbs. of steam per hour. W = 694, p = 75, L = 1700 and D = .282. Applying the formula, we find d = 6 in. This through line there will be of 6 in. diameter.

Application 2. For the group O G H D, the exhaust line near the power plant will carry 27761 lbs. of steam per hour. W = 463, p = 3.5, L = 1700 and D = .0843. Applying the formula we find d = 12 in. *This line is valved on each side of each building branch.* In order to make it proof against shutdowns it is planned as a full 12-in. line from D to L. In case of a failure at any point, the adjoining buildings can be valved off and high-pressure steam can be bled into it at the far end from the through line at L.

Application 3. By the same line of reasoning the principal pipe sizes for group O D I M N were obtained at various points. (See piping chart.)

Group D E F is as yet very indefinite and because of this fact the mains have not been carefully sized by formula. It is estimated that a 16-in. to 12-in. low-pressure line and two 8-in. high-pressure lines will be run from D to F, and that one of these high-pressure lines will be carried beyond F to supply the group of dormitory buildings and the Ross-Ade Bowl, all to be located 1500 to 2000 ft. to the north of distributing point F. This through line will also connect at F with the low-pressure line through three or more reducing valves, as at point L.

Sizes of minor mains and service branches have been obtained from standard tables.

All estimated radiation and principal pipe sizes necessarily were made with a view toward possible future growth of the institution. All pipes are welded. No threads are permitted on any line. Van Stone fittings are used on all valves. Expansion joints on all pipes of 6 in. or above. are all-steel, internally guided; the length of the guide

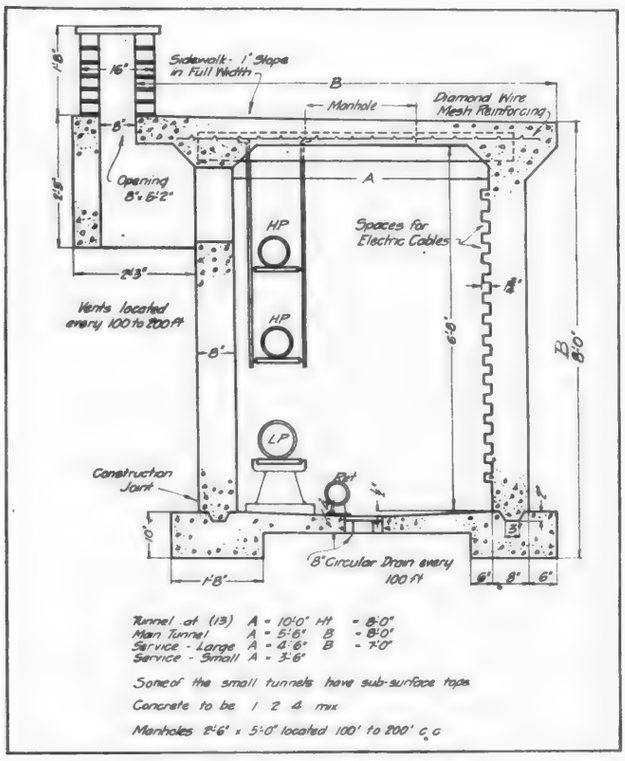

Sidewalk - 1" Slope in Full Width
Manhole
Diamond Wire Mesh Reinforcing
Opening 8'-6"x6'-2"
Spaces for Electric Cables
HP
HP
LP
Vents located every 100 to 200 ft
Construction Joint
8" Circular Drain every 100 ft
Tunnel at (13) A = 10'0" H = 8'0"
Main Tunnel A = 5'6" B = 8'0"
Service - Large A = 4'6" B = 7'0"
Service - Small A = 3'6"
Some of the small tunnels have sub-surface tops
Concrete to be 1 2 4 mix
Manholes 8'6" x 5'0" located 100' to 200' c c

Fig. 4. Details of Tunnel

being three times the pipe diameter. Expansion in the return pipe is taken care of by pipe bends.

At the power plant two tunnel connections eventually will be made to the main north and south tunnel lines. The south line is now in. This will permit low-pressure and high-pressure loops from the boiler to the main steam lines to insure against complete shutdowns.

UNDERGROUND HOUSING

Tunnels were selected in preference to conduits. (See Fig. 4.) Several factors entered into this decision, as:

(a) The advantage in drainage.

(b) The campus being comparatively level and underlaid with gravel, construction work is not expensive.

(c) The convenience of grouping all campus utilities and the consequent reduction of installation and up-keep costs.

(d) Future additions or changes in the utilities will be more conveniently cared for.

(e) The tunnel tops may be used as sidewalks.

(f) Convenience of frequently inspecting condition of insulations.

ONE OF THE STUDIES INVOLVED

Fig. 6 gives the basis for a study of the economics involved in the selection and use of the proposed power plant apparatus.

Three propositions were considered:

1. To buy power and light from the city plant and heat with live steam from a university plant.

2. University power and light plant; condensing. Heat with live steam.

3. University power and light plant; condensing and non-condensing. Heat with live and exhaust steam.

Exhaust steam has approximately the same value for heating purposes as has live steam, and since practically all the exhaust steam will be used in heating, the cost of the electric load was the principal point to be settled.

Considering that section of the campus involved in this study the findings were:

No. 1 Cost of current per K.W.H. per year, peak load	3 cents
Cost of current per K.W.H. per year, off-peak load	2 cents
No. 2 Cost of current per K.W.H. per year	1.44 cents
No. 3 Cost of current per K.W.H. per year	.99 cents

It may be of interest to know that in the operation of the plant since these estimates were made, estimates No. 2 and No. 3 have been lowered. It is further expected that when the power plant and underground system is completed our present actual costs will be considerably lowered.

COSTS OF MATERIALS, EQUIPMENT AND INSTALLATION

The following actual cost data may be of interest:

During the summer of 1926, part of the main tunnel, approximately 700 lin. ft., including branch

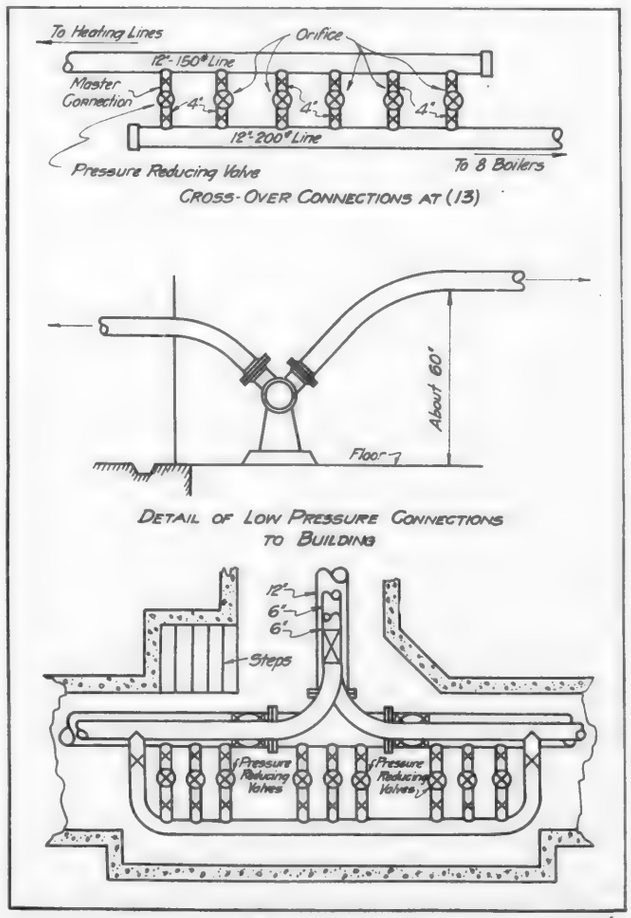
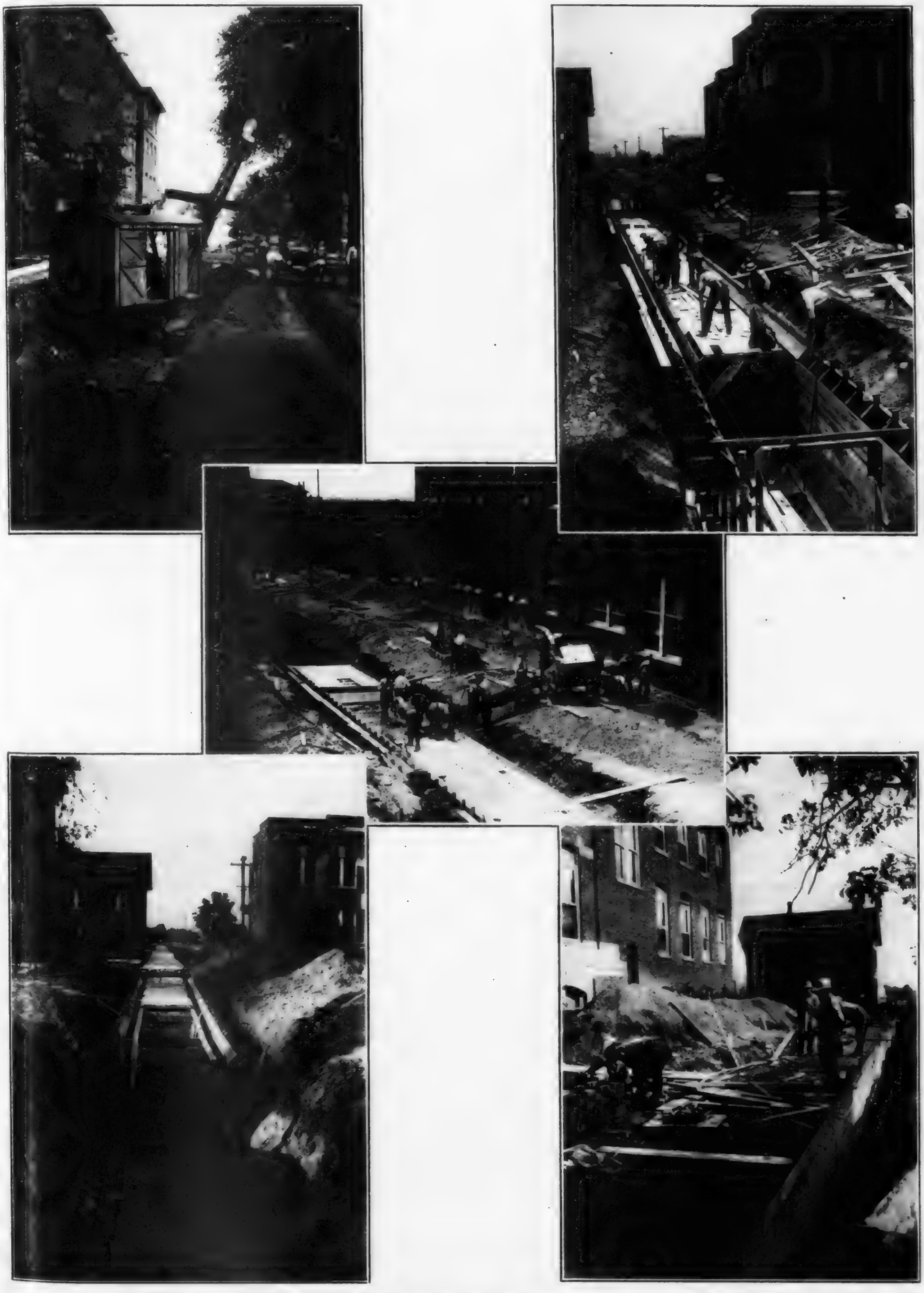


Fig. 5. Details of Piping Connections



Excavating For and Installing Steam Distribution Tunnels in the Campus, Purdue University

tunnels to buildings, between A 16 and A 30, was installed at a cost of $14 per lin. ft. of tunnel. This contract, although seemingly quite low, netted a profit to the contractor.

This summer, 1927, the main tunnel, all branch tunnels to buildings and all piping systems included in the section between A 16 and the power plant (13) will be installed. Contracts just closed call for expenditures as follows:

(1) *Tunnels.* 3200 lin. ft.; sidewalk top, with all ventilators and manholes; also distributing station L complete, $50,300. Cost per lineal foot of tunnel—$15.72.

(2) *Piping systems.* One 12-in. low-pressure main; two 6-in. high-pressure mains; one 4-in. condensate return; low-pressure heating connections to buildings; expansion joints; pipe hangers; roller chairs; anchors; installation of all valves and fittings, etc., to make system complete, $27,042.

(3) All valves for distributing station L; for connections at power plant; for each side of each branch connection to buildings; and all small valves and traps, $3,700.

(4) Pressure-reducing valves, $980.

(5) Pipe covering, 85% magnesia sectional; 1½-in. on low-pressure and 2-in. on high-pressure lines, $8,500.

(6) Pumps for returning condensate from ends of lines and from distributing station L, $1,200.

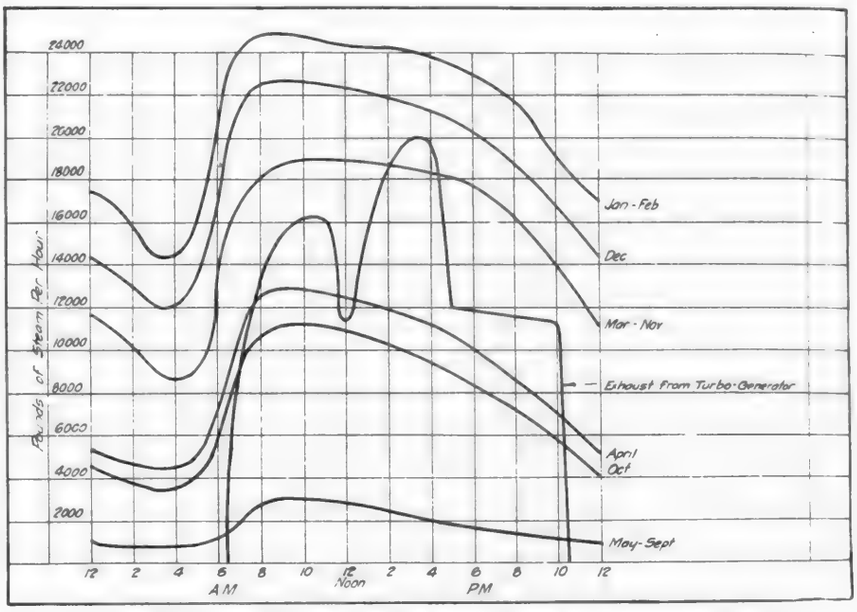


Fig. 6. Estimated Average Daily Load of Heating System

Total, items 2 to 6 inclusive	$41,422.00
Cost per lineal foot of tunnel	12.94
Grand total, all costs per lineal foot of tunnel	28.66

Note 1. The probable cause for increased tunnel costs over similar costs in 1926, was due to the extra width of wall, and extra reinforcing of top and side walls where tunnels six times cross under roadways and three times under railroad.

Note 2. Tunnel costs are probably lower in this contract than in most similar work. Two facts which assisted in keeping down the tunnel costs were a campus that is practically level and a gravel soil.

Note 3. Cost of piping and all fittings and installation is approximately 82% of the cost of the tunnel.

PIPING CHART FOR PURDUE UNIVERSITY'S CENTRAL HEATING SYSTEM

GROUP O G H D			GROUP O D I M N			GROUP A B			GROUP L G Y			GROUP D E F		
Building No.	Radiation. Sq. Ft.	Lbs. Steam	Building No.	Radiation. Sq. Ft.	Lbs. Steam	Building No.	Radiation. Sq. Ft.	Lbs. Steam	Building No.	Radiation. Sq. Ft.	Lbs. Steam	Building No.	Radiation. Sq. Ft.	Lbs. Steam
1	10043	3348	16	50000	16666	A-13	3973	1324	Y	18000	6000	F	100000	33333
6	3160	1053	14	24000	8000	A-14	19850	6616	A-21	4500	1500	36	5000	1666
21	6700	2233	12	23662	7887	A-28	7000	2333	A-24	4500	1500	35	5000	1666
H	3109	1036	17	9000	3000	A-30	7000	2333	A-22	4500	1500	26	7000	2333
2	1600	533	18–19	32000	10666	A-15	7500	2500	A-25	4500	1500	34	7000	2333
9	7148	2383	15	17000	5666	A-16	9000	3000	A-26	5500	1833	33	5000	1666
3	4500	1500	27	12000	4000	A-8	8000	2666	A-27	5500	1833	25	25000	8333
7	1645	548				A-7	4000	1333	A-23	7000	2333	32	5000	1666
4	10618	3539							A-9	4600	1533	37	5000	1666
5	22896	7632										38	20000	6666
10	5368	1789										31	15000	5000
11	6497	2166										24	8000	2666
												20	20000	6666
												30	8000	2666
												29	16000	5333
												23	30000	10000
												28	5000	1666
												22	5000	1666
Totals	83284	27761		167662	55887		66323	22108		58600	19533		291000	97000

Total connected radiation 666,869 sq. ft.
Total pounds of steam circulated 222,289.

PIPECRAFT

Part VII—Steam Mains in General

OUTSIDE of the matter of sufficient size, the most important features of running steam mains are embodied in the *pitch* and in provision for *expansion*. As a general principle it is always better to pitch a steam main down in the direction of the steam flow than it is to try and pitch it against the steam flow; besides, it is more economical as it involves a lesser size of pipe and has the advantage that any sag in the pipe, which otherwise might serve as a reservoir for the collection of water, will have the force of the current of moving steam back of the water to urge it toward the proper drip point.

Caring for the expansion often involves the making of proper provision by the designer of the original layout for the necessary breaks and offsets to absorb the variation in length occurring between the hot and cold conditions of the main. In the best class of work, pipe bends sometimes are installed at strategic points to take up the expansion and, in other work of more competitive nature or where space conditions do not permit the use of bends, the loop or swing joint is used. It is very seldom that expansion joints are employed in such locations although their use for such conditions is not entirely unknown.

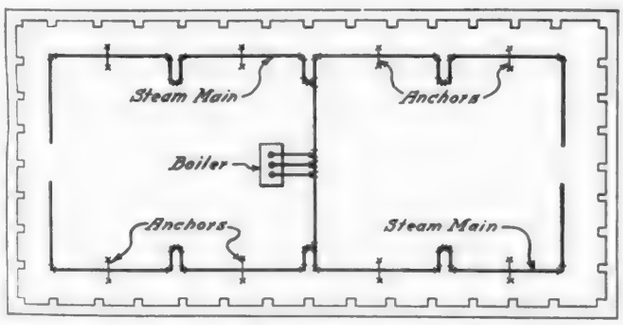


Fig. 52. Proper Method of Branching Mains

The first thing to keep in mind in arranging to take up expansion is that the amount of expansion at any particular point on the pipe should not exceed ½ in., if possible. Consequently, as steam piping for low-pressure systems expands about 1 in. per 100 ft., this means that the distance from the point of maximum movement to the nearest hanger (of the anchor type) must not exceed 50 ft. The corners of a steam main are considered as free ends and are seldom, if ever, anchored. On the contrary, the ends almost invariably are left free and anchors placed 50 ft. back along the main.

This means that if there is a connection located near the corner of the main most good designers will not connect the pipe to the main there but, instead, will run the branch to some point 4 or 5 ft. from the corner, depending on the additional length of small pipe, and the extra spring thus secured, to take up the movement at the corner of the main.

Next, they go back about 50 ft. and place an anchor, then back another 50 ft. and put in a loop or pipe bend, then another 50 ft. and another anchor, continuing this process until they arrive at the boiler or a break in the straight line. Assuming that the steam main is about 5 ft. from the outside wall (as is the usual case), when a point opposite the boiler is reached it is necessary to turn at right angles and run over to the boiler. Where the boiler is set near the middle of the building, there also will be a main coming back from the other half and in about the same location as the first main; where the run over to the boiler is located these mains will meet, but they should not immediately be connected together; instead, both should be stopped and turned toward the boiler just before they come together.

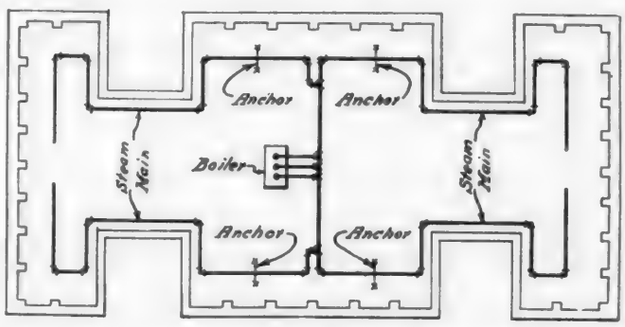


Fig. 53. Breaks in Building Walls Frequently Obviate Necessity for Expansion Bends

After running parallel for a short distance toward the boiler they *then* may be joined up as a single main and connected to the boiler header. The reason for this is that, if connected together out where the two mains meet, it will necessitate a bull-head tee and it also will make the main one solid column, as far as expansion is concerned, and will result in either more movement in the mains or necessitate more loops or bends, neither of which is desirable.

A concrete application of the above is shown in Fig. 52, which is a simple oblong building in which steam mains are required all around the outside walls and the boiler is located approximately in the middle of the building. The steam main is divided up into 50 ft. sections, as previously explained, and anchors and loops are spaced so that the movement will not exceed ½ in. at any point. The main also is broken where it turns across the building to the boiler. And yet, if there had been a couple of light wells in the building, located as indicated in Fig. 53, there would have been little provision needed

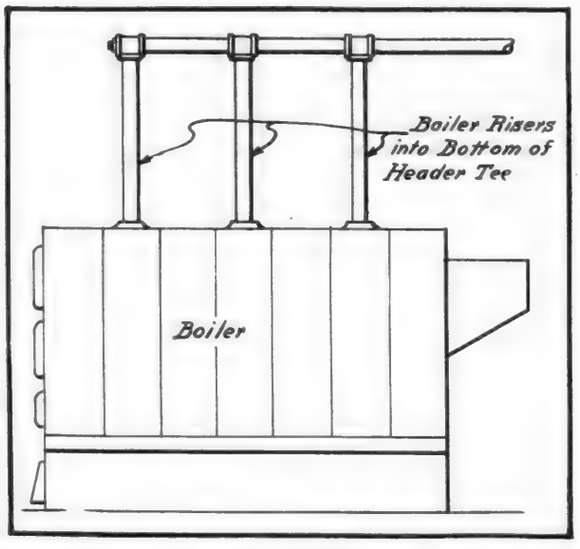


Fig. 54. Conventional English Practice in Connecting Boiler Risers

for expansion, for the breaks around the light wells, as indicated in the drawing, would have been sufficient to provide all the spring necessary to take up the movement of the pipe.

Boiler connections should be piped up with the same reasoning applied, as far as obtaining spring pieces is concerned, and the verticals from the boiler steam outlets should run as high as possible and then turn horizontally and run another 5 ft. or so, and then connect together into the boiler branch or header. This not only will give flexible connections, but also will help to produce dry steam. The fact that all the boiler steam outlets should be used and run up full size has been stated so often and is so well known that it is not necessary to repeat it here.

It seems to be more or less of an English practice to pipe up boilers without the use of the horizontal break at the top of the verticals; in other words, the boiler branch is run directly on the top of the verticals and, when so piped up, gives no trouble. This is illustrated in Fig. 54, but there is no one who will argue against the fact that run-

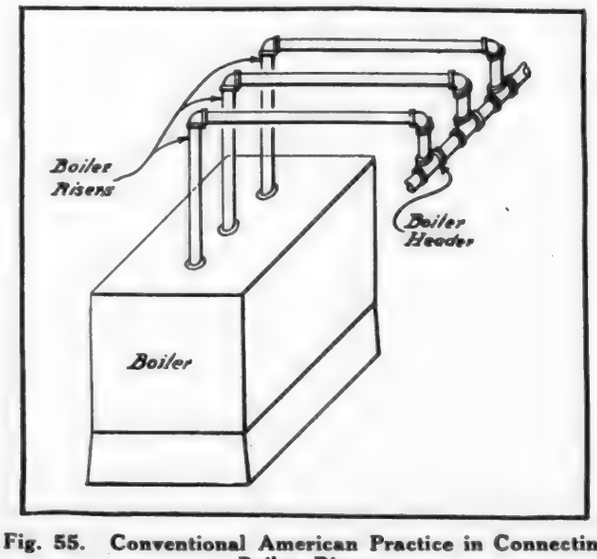


Fig. 55. Conventional American Practice in Connecting Boiler Risers

outs, arranged as shown in Fig. 55, are much more flexible, even though they require a few more fittings to install.

The dripping of the steam main is an item sometimes overlooked in the hurry of installing a job within the contract time limit and, as a result, troubles from water sometimes occur later. Assuming that the main is pitched in the direction of the steam flow, there are two general methods of dripping; the first and simplest is to drip the main at certain and arbitrary intervals, while the second method consists of dripping the main at every branch connection and through the branch.

A modification of the first method, consisting really of a combination of the two schemes, is to drain the main through the branch at every change in pipe size. Of course, drips also must be placed wherever the main jumps up to a higher level.

Dripping Mains for One-Pipe Gravity Steam Systems

In the one-pipe gravity steam system it is customary practice to grade the main toward the far end and to let all the condensation, including the

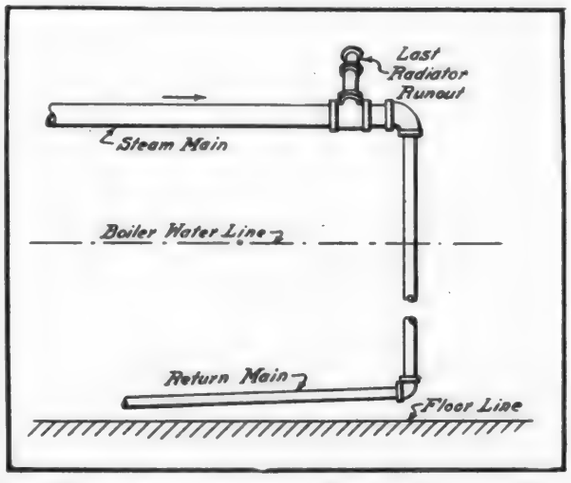


Fig. 56. Proper Arrangement of Return Mains for Dripping One-Pipe Gravity Steam System

radiator returns, flow to this point where it is relieved into a return line preferably of the "wet" variety. Such drips are best made by carrying the main of good size to the end where the drip is located and then turning a reducing ell downward from the smaller outlet from which the drip is taken and carried back to the boiler.

This arrangement is illustrated in Fig. 56, and, if no radiator connection is located close to the end of the main, an air relief also should be provided at this point so that the air will not bank up here and interfere with the flow of the condensate. The air valve will give better service if set slightly above the main level, as shown in Fig. 57, so as to keep it up out of water which sometimes comes in slugs when the system is being warmed up.

Where two mains are used, one for each side of the building, the drips should be carried down below the water-line separately before being connected together so as to overcome in this manner

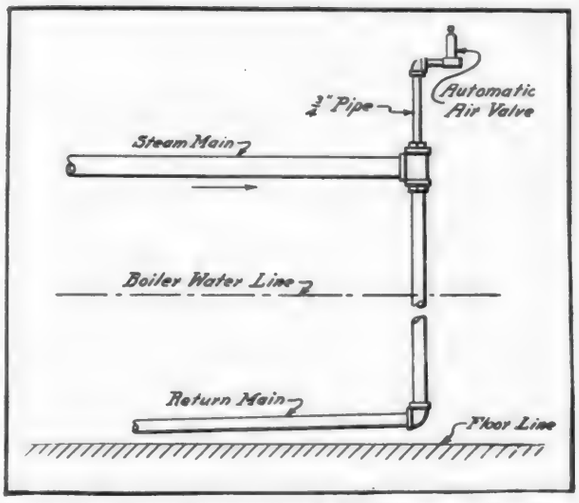


Fig. 57. Proper Location of Air Valve in One-Pipe Gravity Steam System

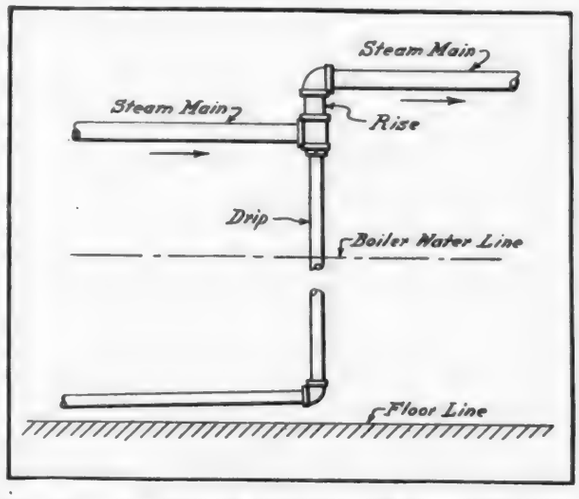


Fig. 58. One Method of "Jumping" Steam Main to a Slightly Higher Level

any pressure difference which may exist between the ends of the two different mains.

In jumping steam mains to a higher level the connections may be made as shown in Fig. 58, with a tee from the top of which the steam main rises while from the bottom of which the drip connection is taken. Better than this, especially for small rises, is the method shown in Fig. 59, where an elbow looking down is used and the rise for the main is placed farther back on the line, because, with this arrangement, there is no chance for the condensation, when coming along the main in slugs, to overload the drip momentarily and jump over the rise as might occur with the connection shown first.

Dripping Vapor Steam Mains

Vapor heating being basically a two-pipe proposition (with the exception of one system), the return main is always run separately and the condensation from the radiators dripped into it with any main drips which may be required connected with the return main through thermostatic traps. This return main is customarily made a "dry" return which gives no difficulty owing to the use of traps on the main drips as well as on all the radiators; where the radiators do not use the thermostatic trap they are supposed to be provided with ample surface to condense all steam admitted to each individual radiator so that there will be no steam or vapor allowed to pass into the return line.

Vapor systems also find it possible to use a "wet" return by venting the end of all steam mains through thermostatic traps and allowing the air to find its way out of the system through an entirely separate air relief line in which a check valve or other special valve is placed to prevent the return of the air, as well as to produce a partial vacuum.

Dripping Vacuum Mains

The draining of steam mains in vacuum systems is largely similar to that pursued in vapor work but the return main in a vacuum system also has the desirable attribute of allowing the main to be lifted (and the return with it) for a considerable distance. The height that the return can be raised depends somewhat on the degree of vacuum carried on the system and such a rise is called a "lift"; the fitting used for this purpose is termed a "lift fitting" and is illustrated in Fig. 60.

It is also possible to improvise a lift fitting for a vacuum return by taking a tee about two sizes larger than the return line and bushing it down to one size smaller than the return main on one end of the run while the other end of the run is plugged and turned down; the branch outlet is bushed down to the return main size and placed at the end of the return main where the lift is to come. Then a long running thread is cut on the vertical pipe and this pipe is screwed down into the tee until it is about 1 in. from the plug; the vertical pipe is carried up to a level slightly higher than the new level of the return main and turned horizontally, and immediately dropped back to the level of the higher main by using two 45° ells as illustrated in Fig. 61.

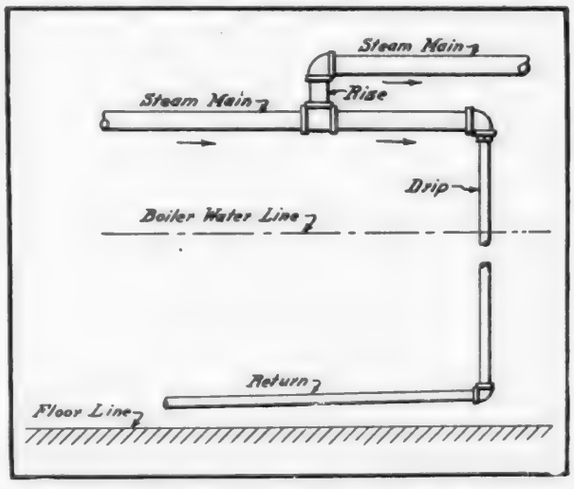


Fig. 59. Method of "Jumping" Steam Main to Higher Level Where Rise is Short

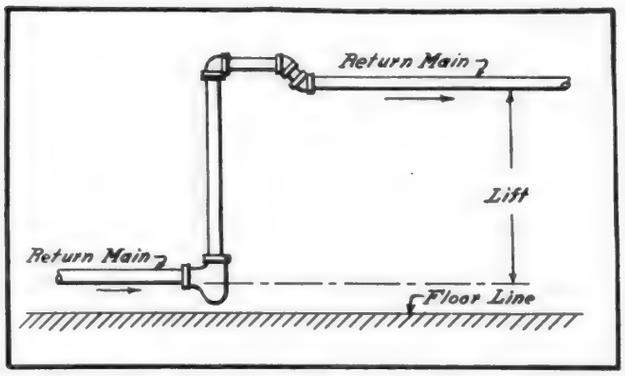


Fig. 60. Illustrating the Meaning of "Lift" and Showing a "Lift Fitting"

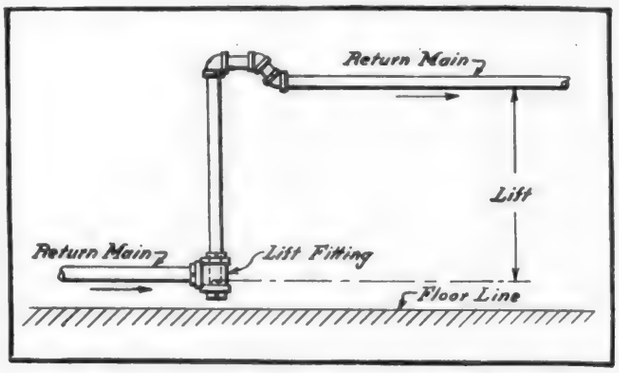


Fig. 61. How to Improvise a "Lift Fitting" for a Vacuum Return

Air Relief for Hot Water Mains

Hot water supply and return mains fortunately do not require dripping but they do demand very careful pitching and provision for air relief. Contrary to steam mains, they customarily are pitched up as they proceed away from the boiler; this pitch, to be of any value, must be constant and continuous. Any air which may collect in such a main will have a natural tendency to rise to the high end, and, where branches are taken from the top of the main or even off at an upward 45° angle, will have to travel only a short distance before this air can enter a riser and ascend to a radiator or other high point where air venting is provided.

Some gravity hot water systems are installed with three types of runouts, these being arranged to equalize the circulation as far as possible. For risers located near the boiler end of the main a downward 45° branch is used (see A, Fig. 62), and for risers in the middle portion of the main a straight horizontal branch (see B, Fig. 62) is used, while for the risers at the far end of the main an upward 45° branch is provided (see C, Fig. 62). This works fairly well on installations of moderate size, the theory being that the risers nearest the boiler, which normally might get hotter water and short-circuit the other risers, only receive water from the bottom of the main, this being cooler than the water on the top. The connections taken off the middle portion of the main receive water from the side of the main and this water is neither the hottest nor the coldest; the farthest risers at the end of the main, which ordinarily might show a sluggish circulation, receive the hottest water and are assisted in this manner, thus getting a sort of preferential treatment over the other connections.

Next month: Connections for boilers in batteries.

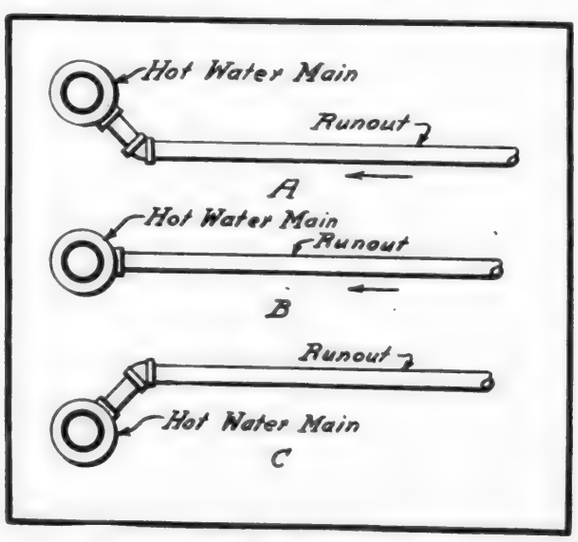


Fig. 62. Arrangement of Three Types of Runouts Used in Gravity Hot-Water System to Equalize the Circulation

Notes on the Design and Testing of Automatic Roof Ventilators

(*Continued from Page* 63)

opening of windows during tests. This easily might lead to cross drafts and variable results although operating the fan and ventilator tests in different rooms would tend to build up the pressure in one room, unless the size and leakage were sufficient to take care of the fan discharge.

In the tests at the Kansas State Agricultural College considerable difficulty with cross drafts was encountered unless extreme care was used in the opening and closing of windows depending upon the weather conditions.

It would appear, from the general interest in roof ventilators, that it would be well worth the while of the American Society of Heating and Ventilating Engineers and of the American Institute of Architects, possibly through their research departments, to work out and adopt a standard test code for the testing of automatic roof ventilators.

This would result in a big economic saving, as the effectiveness of many ventilators of elaborate construction now on the market well could be improved upon by ventilators of better design and cheaper construction. This plan also would eliminate those ventilators which are sold purely through highly-colored advertising designed to play on the imagination and which do not produce satisfactory results.

It would tend to place all manufacturers on a fair competitive basis.

This is the twenty-fifth lesson of
The Heating and Ventilating Magazine's

New Home-Study Course in Gravity Steam and Water Heating

Lesson No. 25 (continued)—Chimneys*

By Ara Marcus Daniels

AIR pressure, as explained with reference to D of Fig. B-2-5, will force air into the ashpit of the boiler, up through the grates and fuel bed into the combustion chamber. A definite quantity of air must be supplied to the fire or the required amount of fuel cannot be burned. Hence, the quantity of air forced through the fuel bed really governs the rate of combustion. Air flow is controlled by pressure difference and this by the frictional resistance of grates and fuel bed. If this resistance is to be constant (and it may be considered practically so for a given boiler) then the pressure difference is the sole controlling factor. This is registered by the draft gage. Hence the draft gage reading may indicate the rate of combustion to be expected from a given boiler-chimney system.

In order to consume a given quantity of fuel on the grates of an average boiler under usual operating conditions, there is required a pressure difference on the two sides of the fuel bed, that is, in the ashpit and in the combustion chamber, of approximately 0.01 in. of water per pound of coal burned per square foot of grate per hour. Thus, if heating demands require a combustion rate of 5 lbs. of coal per hour per square foot of grate, the difference in draft intensity between ashpit and combustioin chamber must be 0.05 in. of water.

Work Problem B-2-7.

Under definite temperature conditions, a flue of a given height will produce a certain intensity of draft. When the flue is a part of a boiler-chimney system, there are five principal factors that affect the degree of intensity—(1) the resistance to upward flow of the gases in the chimney due to their rubbing against the sides (frictional resistance) and the cooling effect of the chimney, (2) the frictional resistance in the smoke pipe, (3) the resistance to flow through the passages of the boiler, (4) the resistance to the passage of air and gases through the grate and fuel bed, and (5) the resistance to air flow into and through the ashpit. All these factors act to lessen available draft intensity.

Work Problem B-2-8.

Reference to Fig. B-2-9, showing a diagrammatic view of a boiler connected to a chimney flue, the top of which is assumed to be 45 ft. above the grate level, and the following will show how draft losses occur.

For the sake of clearness, draft gages have been shown as U-tubes rather than of the inclined type. Locations A, B, C and D have been selected as

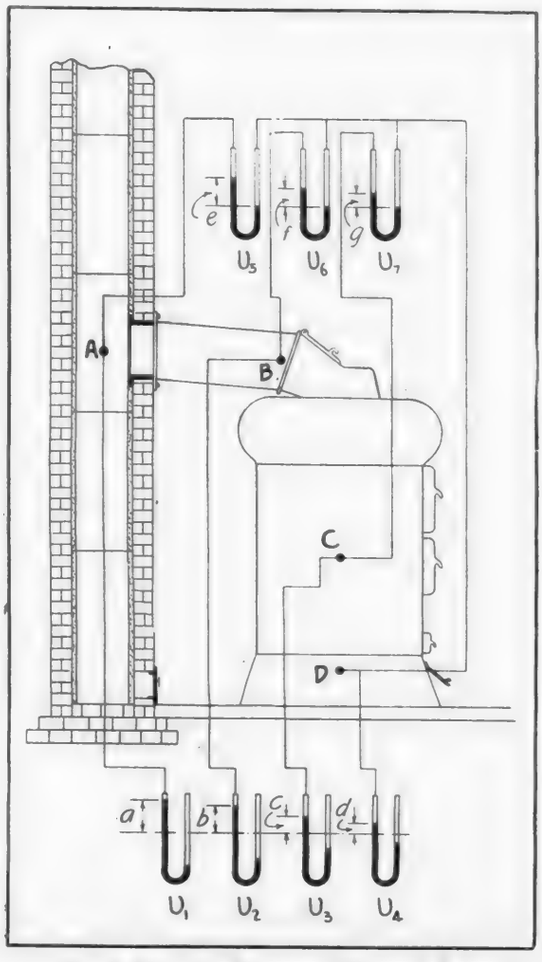


Fig. B-2-9. Draft Losses Through Boiler

Copyright, 1927, Ara Marcus Daniels.

points through the boiler-chimney system at which it is desired to know the intensity of draft and to observe how draft losses occur.

Location A is in the flue at the point where the smoke pipe enters; location B is at the smoke-pipe-heater connection; location C is in the combustion chamber just above the fire and location D is in the ashpit just below the grate.

For the time being, it will be assumed that the U-tube draft gages marked U_1, U_2, U_3, and U_4 are the only ones connected at points A, B, C, D. Each of these has one leg connected to the respective point while the other is open to the atmosphere.

By making certain assumptions, there can be established the theoretical draft which this chimney will produce if no frictional losses occur. Then if the intensity be measured at different points, the total loss due to these resistances may be determined and the actual draft available for operation found. If the products of combustion enter the chimney at 400° F. and in their upward passage cool to 300° F. before leaving at the top, the assumed average flue temperature will be 350° F. Based on this average temperature within the flue and a 0° F. temperature for the outside air, this chimney should produce a theoretical draft of 0.25 in. of water. The formula by which this may be calculated is given at the bottom of Table B-2-1.

Work Problem B-2-9.

TABLE B-2-1. CHIMNEY DRAFT INTENSITIES, INCHES OF WATER

(Values taken at 0.80 of theoretical)

Height of chimney, ft.	Average Temperature of Flue Gases, Deg. F.						
	200	225	250	275	300	325	350
20	0.07	0.08	0.09	0.10	0.10	0.10	0.11
25	0.10	0.10	0.11	0.12	0.13	0.13	0.15
30	0.11	0.12	0.14	0.14	0.15	0.16	0.17
35	0.13	0.14	0.15	0.16	0.18	0.18	0.19
40	0.15	0.16	0.18	0.18	0.20	0.21	0.22
45	0.17	0.18	0.20	0.21	0.22	0.23	0.25
50	0.19	0.20	0.22	0.24	0.25	0.26	0.27
55	0.21	0.22	0.25	0.26	0.27	0.29	0.30
60	0.23	0.24	0.27	0.28	0.30	0.31	0.33

Formula for theoretical draft: $H = 7.64h \left(\frac{1}{Ta} - \frac{1}{Tc}\right)$

H = total head produced by chimney, inches of water.
h = height top of chimney above grate, feet.
Ta = absolute temperature of air = 10° F. plus 460° F.
Tc = absolute average temperature of chimney gases = average temperature plus 460° F.

Theoretically, if one leg of draft gage U_1 were connected to location A and the other open to the atmosphere, the difference in elevation of the water in the two legs would read 0.25 in. A gage so connected, though, would indicate a value slightly less, owing to the frictional resistance of the flue and its cooling effect. With the gage U_1 graduated to read directly in inches of water, the distance *a* on U_1 may be assumed to read 0.23 in. of water.

Passing next to U_2, a still lower reading will be registered which, designated as *b*, properly may be assumed 0.225 in. of water. This difference of 0.005 in. of water between locations A and B is caused by frictional resistance in the smoke-pipe.

Between locations B and C, a greater loss of draft intensity may be expected, so U_3 may be assumed to read 0.200 in. of water, represented by C, or to indicate a loss of 0.025 in. of water between B and C. Again in similar manner, the draft intensity reading on U_4 for location D, and shown as *d*, may be read as 0.190 in. of water, indicating a loss of draft through the grate and fire of 0.010 in. of water.

Thus, draft intensity to be expected, owing to losses, will be 0.190, instead of 0.25 in. of water, as theoretically computed.

In Table B-2-2, the various draft intensities and losses at different locations and between the several points are tabulated for ready reference.

TESTING THE DRAFT

Obviously, it is not always feasible to take draft gage readings at each location, as explained in connection with Fig. B-2-9. It is essential always to make at least one reading of the draft and this

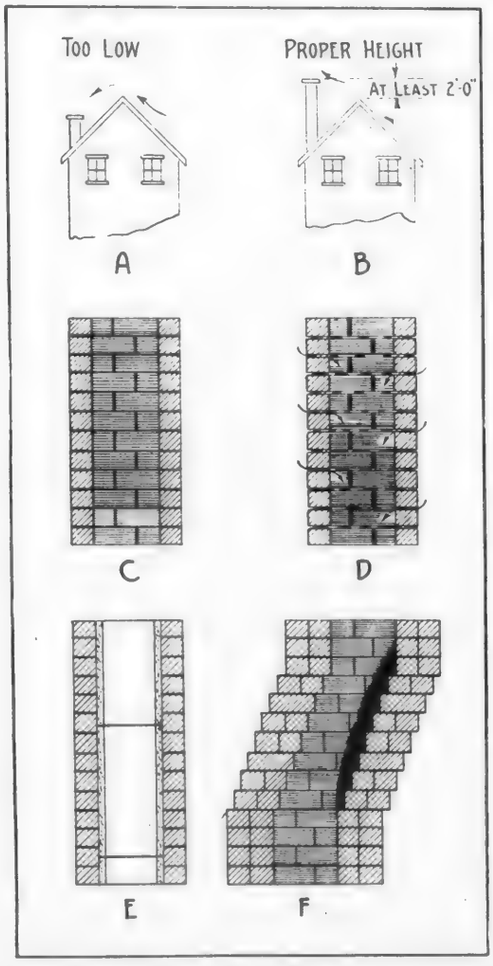


Fig. B-2-10. Examples of Bad Chimney Construction

TABLE B-2-2. DRAFT INTENSITIES AND LOSSES

Draft Available, In. of water		Draft losses, In. of water	
Theoretical	0.25	In flue	0.020
At smoke-pipe entrance to flue	0.23	In smoke-pipe between B and A	0.005
At smoke-pipe entrance to heater	0.225	Through combustion chamber between C and B	0.025
In combustion chamber	0.200	Through grate and fire between D and C	0.010
In ashpit	0.190	Total loss	0.069

should be taken in the smoke-pipe just outside of the chimney.

Using a draft gage of the inclined type, care must be exercised to see that it is level before making readings. Each gage is fitted with a level for this purpose. A draft connection can be made by punching a small hole in the smoke-pipe and inserting therein a small metal tube connecting the outer end to the gage through rubber tubing. A zero reading of the gage should first be made with both ends of the gage open to the atmosphere. Then the check damper should be closed, the ashpit door opened and the fire in the boiler permitted to burn long enough to be assured that the combustion rate is as high as the chimney will produce before taking the reading.

In Fig. B-2-9, the draft gages marked U_5, U_6, and U_7 represent a differential gage. By the use of a differential draft gage, the difference in draft intensity between the two points to which the two legs of the gage are connected is read directly. For example, gage U_5 has its left leg connected to location A while the right leg connection communicates with location D and the pressures existing at these respective points act on the two water surfaces.

If the pressures were equal, the water levels in each leg would agree, but since the draft intensity at A is greater than at D, there will be a difference in the two levels. If a movable scale be used and its zero mark be placed in line with the lower level, the loss in pressure between A and D will be indicated by the measurement of the difference in levels. Height *e* on gage U_5 would, in this case, read 0.060 in. of water, *f* on gage U_6 would read 0.035 in. of water, while *g* on gage U_7 would read 0.010 in. of water, all of which agree with the differences noted in Table B-2-2.

Work Problem B-2-10.

CHIMNEY TROUBLES

The required area for a flue depends upon the quantity of smoke or gases that it must pass and the velocity at which gases will flow upward. Reliable available data on the performance of chimneys are lacking, particularly as regards what takes place in the chimney itself. The variations of temperature, density, and draft from the top to the bottom for the various shapes and sizes of flues are practically unknown, so far as the writer is informed. The velocities and volumes throughout the length of the flue are not definitely known; the effect of the wind is not thoroughly understood, particularly with reference to air leakage into the chimney under heavy winds, its effect upon the cooling of the gases and to the suction effect that it may produce directly over the top of the chimney. All of these factors have an appreciable influence upon the size or area that may produce the best results and, until carefully-developed data on these features are available, recommended sizes only can be such as experience has shown to give good results.

Unquestionably the height of a chimney is one, if not the most important, factor in chimney design. It must be high enough, not only to be capable of producing sufficient draft, but to avoid the danger of air currents which may mar the draft (See A and B, Fig. B-2-10). The top of a chimney should extend 3 ft. above flat roofs and 2 ft. above the ridge of peak roofs. Extensions, if used to add height, should be properly fitted. If the joint between a brick and a metal extension is not tight, its service may well be questioned.

Unlined chimneys are a source of continual trouble. Frequently tight when first constructed, the heat and weather cause the mortar gradually to disintegrate so that air leaks in at the joints, with a consequent lessening of the draft. At C, Fig. B-2-10, is shown an unlined chimney before use, while at D its appearance after being in use is illustrated.

Offsets or bends in chimneys are likely to reduce the area or loose bricks, and mortar may fall into and lodge in such a way as to cause restrictions. (See F, Fig. B-2-10 and note how soot accumulation may cause restricted area.)

Careful installation of the smoke-pipe in the chimney is essential. Wrong methods are indicated at A and B, Fig. B-2-11. At A, the pipe does not set in far enough and an opening exists around the pipe. This opening acts as a check damper. The projecting pipe at B causes serious interference of gas flow. At C, the pipe is of proper length, has a cement-tight joint and close-fitting collar plate, assuring gas tightness and free unobstructed gas passage.

Openings into a chimney for other than the smoke pipe of the boiler should never be permitted if unsatisfactory draft is to be avoided. If a soot

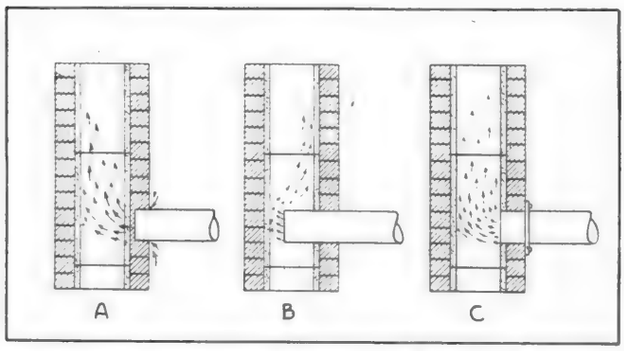


Fig. B-2-11. Incorrect and Correct Methods of Making Smoke-Pipe Connections

pocket is provided at bottom of flue, the clean-out opening should be equipped with a tightly-fitting cover which should be always in place except when removed for cleaning soot accumulations.

Work Problem B-2-11.

SIZE AND HEIGHT OF CHIMNEY

The establishment of size and height of the chimney for a given installation properly demands consideration of the total heat demands, the type and number of boilers to be used, the fuel to be burned, and the character and altitude of the building. Therefore, the determination of size and height of chimney should be the last part of the heating design.

Various tables for chimney sizes have been prepared and are found in trade catalogs and the like. Reputable boiler manufacturers specify draft requirements for their respective boilers and usually give required flue areas, sizes and heights of chimneys.

Irrespective of whether the fuel to be used is coal, coke, wood or oil, the minimum effective area inside of the flue linings for any steam or water boiler should not be less than 70 sq. in. and the short cross-sectional dimension never should be less than six-tenths the greater dimension.

Work Problem B-2-12.

The quantity of smoke and gases to be handled by a flue depends on the quantity of fuel burned in a given time. Therefore, the combustion rate and area of grate should be known. Table B-2-3, recommended by the American Society of Heating and Ventilating Engineers for low-pressure heating boilers, embodies a consideration of influencing factors and represents conservative modern practice in the matter of chimney sizes.

Work Problem B-2-13.

The sizes of flues there given are based on run-of-mine soft coal, but may be used without reduction for other fuels. If screened coal, smaller than nut size of anthracite or coke is used, increased draft is required and the installation demands special consideration.

If the installation is located where the altitude exceeds 500 ft. above sea level, the height of the flue should be increased as follows:

Increase height of flue by 10% for each 1000 ft. above sea level and reduce the capacity by 5%.

Work Problem B-2-14.

EFFECTIVE AREA

The effective area of a flue, broadly speaking, is the theoretical cross-sectional area which the column of smoke and gases rising with a spiral motion will occupy in the passage up the flue.

In a round lined flue, the entire area is considered effective area. In a square lined flue, the effective area is considered as equal to the area of a circle, the circumference of which is tangent to the inside surface of the flue or, in other words, a circle whose diameter is equal to the shorter inside dimension of the flue.

The effective area of a rectangular lined flue is determined as follows:

TABLE B-2-3. CHIMNEY SIZES

Steam Boiler Capacity, Sq. ft. of Radiation	Hot Water Heater Capacity, Sq. ft. of Radiation	Nominal Dimensions of Fire-Clay Linings, In.	Rectangular Flue			Round Flue	
			Actual Inside Dimensions of Fire-Clay Lining, In.	Actual Area, Sq. In.	Effective Area, Sq. In.	Inside Diameter of Lining, In.	Effective Area, Sq. In.
590	973	8½ x 13	7 x 11½	81	70		
690	1140					10	79
900	1490	13 x 13	11¼ x 11¼	127	99		
900	1490	8½ x 18	6¾ x 16¼	110	100		
1100	1820					12	113
1700	2800	13 x 18	11¼ x 16¼	183	156		
1940	3200					15	177
2130	3520	18 x 18	15¾ x 15¾	248	195		
2480	4090	20 x 20	17¼ x 17¼	298	234		
3150	5200					18	254
4300	7100					20	314
4600	7590	20 x 24	17 x 21	357	278		
5000	8250	24 x 24	21 x 21	441			

Height in feet from grates: As height necessary is dependent upon the draft requirements of the varying designs, these factors should be known before height can be determined accurately.

First: Note the short inside dimension.
Second: Subtract the short inside dimension from the long inside dimension.
Third: Multiply result First by result Second.
Fourth: Multiply the short inside dimension by itself, and multiply the product thus obtained by 3.14.
Fifth: Divide result Fourth by the numeral 4.
Sixth: Add result Fifth to result Third, and obtain the effective area in square inches.

Work Problems B-2-15 and B-2-16.

If an existing flue is to be used or it is necessary to build a flue that is more than 100% in excess of the areas given in Table B-2-3, the chimney should be capped with stone terra-cotta, cast-iron or other approved material. The opening through the capping should be not more than 50% in excess of the required area.

Work Problem B-2-17.

When a battery of two boilers is to be used, the rated capacity of the flue should be taken at 60% that in Table B-2-3. Thus, if two boilers, each with a rated capacity of 1940 sq. ft. are to be used, the required effective area of a suitable round flue will be 177 (effective area) $\div$ 60 $\times$ 100 or 290 sq. in. Table B-2-3 indicates that a round flue of 20 in. diameter should be used.

Work Problem B-2-18.

If three boilers are to be installed, 40%, instead of 60% should be used; for four boilers, use 35%.

Work Problem B-2-19.

The next lesson, to appear next month, will cover boiler capacities and ratings, determining demands, flue gases, boiler efficiency and heat losses.

Ventilation Requirements of America's Theatres

"IF ideal air conditions were provided in all the theatres of America, with the correct proportions of air motion, it would require the pumping of more than five trillions of cubic feet of air every day during the hours that the movies are operated," is the declaration of Director F. C. Houghten of the A.S.H. & V.E. Research Laboratory, based upon the physiological tests conducted at the laboratory in Pittsburgh, in co-operation with the United States Bureau of Mines. "This is the amount necessary," explains Mr. Houghten, "properly to carry off the body moisture and odors of the audience which, in a national way, runs into heavy tonnage. It works this way. There are 24,268,800,000 cu. ft. of air space in the nation's moving picture theatres. If this air were changed every three minutes, which is best for good health, this would mean a total of 485,376,000,000 cu. ft. of air per hour or 5,330,136,000,000 cu. ft. of air pumped in eleven hours, assuming that all the theatres are open to the public that long each day."

These figures show that the 300,000 persons permanently employed in the movie industry lose a minimum of 311,940 lbs. every day, which would be the amount lost if they were sitting quietly. But with most of them doing a day's work in eight hours, exerting and rushing themselves, the amount of metabolism would be doubled or tripled so that the weight lost would be closer to 1,000,000 lbs.

Several screen stars have said they each lose 3 to 4 lbs. of weight in less than an hour when making some pictures where rapid-fire action or unusual athletic feats are required. An audience will give off more heat and moisture when excited.

"No one ever weighs the same every minute," Mr. Houghten concluded. "One loses more weight in a hot, dry atmosphere."

The School Population of the United States

IN a recent report of the United States Bureau of Education it was stated that 26,458,655 pupils of all ages were enrolled in and attending some kind of school, either public or private. (These figures are based only on reports received by the bureau.) When we remember that many institutions either do not fill out these reports at all and some give incomplete data, then it seems quite possible that we have to do with the housing conditions, at some time or other, of nearly one-third of our national population—an astounding number.

Rural districts are credited with 186,532 buildings while cities of 2500 population or over are estimated to have about 57,000 more, a total of almost 250,000 buildings, ranging from the one-room structure housing a half-dozen children, to the palatial cosmopolitan high school, accommodating 4,000 or 5,000. It is no wonder that some of the best engineering talent of the country is interested in this vast problem of providing proper air conditions for 35 millions of human beings.

If a building is improperly constructed, unsafe or poorly heated or ventilated, then we stay away; we are not obliged to enter or stay in it. The public school, however, is a different matter. Our attendance laws *require* a child to attend school and *remain* there for from four to six hours per day five days a week and for ten months of the year—he has no choice. Under those conditions it is our *duty* to provide an environment which is hygienic and conducive to physical comfort. — H. W. SCHMIDT, *supervisor of buildings, Wisconsin Department of Public Instruction, before the National Association of Public School Business Officials.*

The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress

MEMBER

National Publishers' Association
Associated Business Papers, Inc.
Audit Bureau of Circulations
National Trade Extension Bureau
American Oil Burner Association

VOL. 24 August, 1927 No. 8

Published Monthly at New York, N. Y., by the
HEATING AND VENTILATING MAGAZINE COMPANY
Executive and Editorial Offices, 1123 Broadway, New York.

A. S. ARMAGNAC . . . . . President
GUSTAVE PETERSEN . . . . . Treasurer

EDITORIAL DEPARTMENT

A. S. ARMAGNAC, Editor. P. E. FANSLER, Associate Editor.
H. L. ALT, Technical Editor.

ADVERTISING DEPARTMENT

G. PETERSEN, Manager.
GEORGE A. BROWN, Eastern Representative.

Western Office . . . . . 105 So. Dearborn St., Chicago
CLIFF W. PRESDEE, Manager .

European Representative
W. G. Hollinworth,
124 Wrottesley Road, Harlesden, London, N. W. 10, England

Subscription	$2.00 per year
Canada	2.50 per year
Foreign Countries	3.00 per year
Back Numbers	50 cents each

TECHNICAL and business papers are having a delicate duty to perform these days in the so-called censoring of advertising copy. Quite naturally, the advertiser may take the stand that he is paying for the space he occupies and, therefore, has a right to make any statement he pleases within legal limits. If his claims are unjustified or his comparisons with the products of other manufacturers invidious, his competitor, he may argue, has the same privilege and, in the long run, the reader will judge between them. As a matter of fact, the man who takes this position, almost without exception, is so thoroughly convinced in his own mind of the superiority of his product that he cannot conceive of his claims being unjustified or his comparisons unwarranted.

For some time now the technical and business press, members of the Associated Business Papers, have subscribed to the code of ethics promulgated by that body, binding them, among other things, "to subscribe to and to work for truth and honesty in all departments" and "to decline any advertisement which has a tendency to mislead or which does not conform to business integrity." While this code imposes upon publishers the responsibility of keeping their columns up to the required standard, it is not an arbitrary requirement, by any means, but one designed as much in the interest of the advertiser as that of the publisher.

Assume, for example, that an enthusiastic advertiser insists on featuring his product as "the best of its kind," "superior to any other similar device," so functioning that "there is no danger of its doing this or that," naming in detail the frailties that might apply to a competitor's device, and winding up with the modest admission that his appliance will give "perfect satisfaction." It is dollars to cents that the next issue will carry the "comeback" announcement of the competitor whose "ox is gored" and it will embody a thousand and one reasons why his own product will outlast and outdo that of his rival, all of which will constitute a thinly-veiled attack on the honesty and sincerity of the original announcement. What each advertiser overlooks is the fact that his advantage can be only temporary at best and is bound to provoke additional propaganda designed to minimize, if not nullify, his well-planned broadsides.

Advertisers have certain rights, yes, but how about the rights of the one whose product is being belittled and who may be paying for an adjoining space in the same publication? Is it fair to him to accept his money and then to permit a competitor to present advertising material which is likely to make the other advertiser look foolish?

FINALLY there is the reader to consider. Is an advertiser justified in appealing to the reader's intelligence with statements that his product is "perfect," that "it will effect a fuel saving of from 25% to 40%" (there seems to be some magic in these particular figures when applied to fuel saving) or that it eliminates trouble due to this or that feature of construction which is characteristic of a rival's device? After all, the average reader of a technical journal has many of the attributes of the man "from Missouri." Sometimes he may seem to be too "hard-boiled," but certainly in the matter of advertising claims he is not one to be easily misled by phrases that will not bear the light of analysis. His interest is in the design, construction and operation of the various products advertised and many an advertiser, we dare say, would be amazed to see a reader pass by with scant notice the flaring claims of one advertisement and pounce eagerly upon the intelligent presentation, in another advertisement, of a device of the same general type. Writers for the technical press are aware of the requirements in this respect and are careful not to lose the confidence of their readers by injecting "loose" statements or evidence of bias.

As we all know, the advertising pages of a first-class technical journal are fully as interesting as the reading pages. So there is every reason for the movement for higher standards in the presentation of advertising material. It means a stronger and better appeal and is even a factor in the elimination of waste by promoting quicker and more effective contact between advertiser and reader.

What's Wrong with This Code?

Basis Proposed by A. S. H. & V. E. for Rating Low-Pressure Heating Boilers Is Open for Discussion

FOR many years the compilation of a code by which low-pressure heating boilers could be comparatively rated has been the goal of the A. S. H. & V. E.

As reported last month in these columns, the summer meeting of the society marked the achievement of the first definite step in this direction, when the society's Committee on the Rating of Low-Pressure Boilers made its report. After a brief but lively discussion, which developed nothing of constructive value to the committee, the report was "accepted in principle," the committee was continued and instructed to present a final draft at the next annual meeting, embodying such desirable modifications as might develop in the interim.

The success attending the efforts of this committee in no small way was predicated upon its composition—no one of the members was directly or indirectly interested in the manufacture or sale of the equipment under consideration.

The chairman, Alfred Kellogg, is a prominent consulting engineer of Boston, with a remarkably well-rounded experience, particularly covering the utilization of heating boilers. S. R. Lewis, consulting engineer, Chicago, chairman, Committee on Research of the society, is the dynamic leader of the movement to make research pertaining to heating and ventilating as comprehensive and far-reaching as possible. F. C. Houghten, director of the Research Laboratory, is well known as a hunter after technical facts and truths. Prior to assuming his present position at the Laboratory he enjoyed a valuable experience in the Bureau of Mines, where he personally supervised many tests on heating boilers. Percy Nicholls, supervising engineer, Fuel Section, U. S. Bureau of Mines Experiment Station, Pittsburgh, is an unassuming and almost self-effacing research scientist with few peers in this or any other country. Mr. Nicholls has placed at the disposal of the committee all of the experience and data collected by the Bureau in its extensive testing of heating boilers. L. E. Seeley, instructor of mechanical engineering, Yale University, is one of the younger generation of college instructors, who divides his time between the imparting of knowledge to students and the acquirement of facts through practical testing of equipment in the laboratories of the Sheffield Scientific School.

In the opinion of the committee members themselves, this code represents only a starting point, yet year after year has gone by without even getting that far. The code, as presented by the committee, follows. It is presented largely with the desire to assist the committee in propagating its text in order that intelligent suggestions thereon may be forwarded the committee prior to presentation of the final draft at the next annual meeting of the society.

To that end the columns of The Heating and Ventilating Magazine are placed at the disposal of its readers for the development of constructive ideas or criticism.

Supplementary to the presentation of this code there will follow next month the comments of this committee in making its report.

(Issue of June, 1927)

THE purpose of giving low-pressure heating boilers rating values as are defined by the code, is limited to that of permitting comparisons between different boilers on the basis of their ability to take care of maximum demand.

RATING DEFINITION

The rating of a low-pressure steam heating boiler is to be the average output per hour obtained from it when using the method of test specified in the code, and when not exceeding the following limiting conditions:

1. The moisture in the steam during the test period, as determined by an approved steam separator, shall not exceed 2% by weight of the total steam and moisture delivered.

2. The average temperature during the period of test of the flue gases leaving the boiler shall not exceed 700° F.

3. The average carbon dioxide (CO_2) in the flue gases during the period of tests shall not be less than 12% by volume by flue-gas analysis when burning anthracite or coke, and not less than 10% when burning bituminous coal.

4. The average carbon monoxide (CO) in the flue gases during the period of test shall not be greater than 1% by volume by flue-gas analysis.

STANDARD RATINGS

There shall be two standard ratings, to be termed the *Anthracite Rating* and the *Bituminous Rating*, respectively. Either anthracite or coke may be used to determine the Anthracite Rating values.

The permissible fuels that may be used in the standard rating tests are:

Anthracite—Any anthracite which by proximate analysis has not more than 8% volatile on a moisture-and-ash-free basis may be used. There shall be no limitation to size of fuel permissible.

(Proximate chemical analyses usually include the moisture and ash. The percentage volatile on a moisture and ash free basis is computed by simple proportion and is: actual volatile percentage multiplied by the fraction $\frac{100}{100 - \text{(moisture + ash) percentage}}$

Coke—Any high-temperature coke may be used. Coke screen sizes are not standardized but the use of any sizes between 2½ and 1-in. screens is permissible.

Bituminous Coal—The coal to be used in bituminous rating tests shall be a coking coal and equivalent to a Pittsburgh bed or an Upper Freeport bed coal having, by proximate analysis, 35% to 40% volatile matter content on a moisture and ash-free basis.

SPECIAL RATINGS

It is recommended that manufacturers should determine and publish both the standard ratings for boilers which are sold for general use with any solid fuel, thus making it simpler to establish codes which will assist purchasers in properly selecting boilers. It is recognized, however, that there are types which are designed primarily for use with a particular fuel, and therefore that fuel would be used in determining the ratings. Ratings determined with other than the two standard fuels shall be published as Special Ratings, and the fuel used in the test shall be specified by type, bed or other manner necessary to clearly define it. The same limiting conditions and test specifications shall be used for special rating tests as for the standard, except that when using fuels high in free hydrogen, or low grade fuels it shall be permissible to lower the allowable average CO_2 content of the flue gases to 8%.

RATING DATA

The essential data required from the rating tests are:

1. Fuel, kind and size used in the test.
2. Rating output.
3. Draft required expressed as inches of water or as chimney size necessary.

TEST SPECIFICATIONS

General—This code recognizes the limited purpose of the test and calls for

the minimum number of measurements, and introduces no unnecessary restrictions; because the output to be determined is that of maximum demand. The boiler when in service will but rarely have to deliver as great an output, and then not continuously for a long period, so that the attendant will be required and will expect to give it more than normal attention.

Alternative methods of tests are made permissible, termed Test Method *A* and Test Method *B*.

Test Method *A* measures the output, that is, the steam delivered, by using a closed condenser in which the steam is condensed. The weighing of the condensate gives the steam output. This method is recommended as being more accurate since the results are little affected by difference between the water level in the boiler at the start and finish of the test.

Test Method *B* measures the output by the weight of water fed to the boiler during the test, and calls for the water level to be the same at the beginning and end of the test.

TEST SET-UP

Boiler—It is recommended that the boiler be set up and insulated as it will be when installed, but if desired the test may be run without its being insulated. The method of computation credits the output with the loss due to the absence of the insulation, but does not permit of any credit for possible increase of moisture in the steam.

When determining catalogue ratings the test shall be of a stock boiler without any modifications except as specified.

The steam piping, including all drums and nipples, shall be insulated up to and including the steam separator.

A steam separator of approved design shall be installed as near to the boiler outlet as the design permits. The drain pipe shall include a U-leg sufficiently long to prevent steam blowing out. The drip shall be caught in a container, and weighed separately.

The steam valve shall be placed beyond the steam separator. The steam piping leading from the separator shall have a slope so water condensed in it will drain from the separator.

The water gage should have a permanent mark to show the water level recommended by the manufacturer. For the purpose of this test a mark corresponding to this shall be put on the gage glass.

Smoke Flue—The smoke flue shall have the area specified by the manufacturer and shall be equipped with a damper, in addition to any damper incorporated in the boiler itself. The damper should be a sufficient distance along the flue to permit of the gases coming from the various outlets of the boiler being thoroughly mixed, thus facilitating the collecting of a true average gas sample and obtaining their average temperature. This distance, not including the connecting box, shall be not less than two or more than four times the equivalent pipe diameter.

There shall be no check damper before the flue damper, and if one is incorporated in the boiler construction it shall be sealed thoroughly.

All joints before the flue damper shall be sealed thoroughly with cement and maintained so during the test.

The smoke flue up to the flue damper shall be insulated with not less than 1-inch thickness of suitable insulation. The object of this is to permit of a more accurate and comparable measurement of the flue-gas temperature.

MEASUREMENTS AND INSTRUMENTS

Condenser—For Test Method *A* the steam pipe from the separator shall be run to a surface condenser, and shall have a fall so that all condensation therein will run to the condenser. The condenser should be so set up that all condensate will quickly drain to the outlet. It should be of sufficient capacity that the condensate temperature will not exceed 150° F. and should be connected to the atmosphere so that no vacuum can be created.

Before each test the condenser should be tested for freedom from leakage by putting it under full water pressure.

The condensate shall be caught in suitable tanks and weighed. The piping should be so arranged that the water can be quickly diverted to or from the weighing tanks.

Feed Water—The necessary and most convenient feed-water equipment will depend on the size of boiler. It should be such that the pressure behind the feed adjustment valve will not vary. Two valves, in series or parallel, facilitate control of the water level.

For Test Method *A* the feed water is not measured and the boiler-feed line may be connected to a storage tank or to the supply line as may be more convenient.

For Test Method *B* the feed water delivered to the boiler shall be weighed.

(For smaller boilers a supply tank mounted on scales can be put at a sufficient height so that the water will feed by gravity. If the boiler is fed directly from a single weighing tank there should be two valves in series, one for adjusting the rate and one a plug valve for stopping the flow while the tank is being weighed. When two weighing tanks are used they should be so piped that the feed can be quickly changed from one to the other.)

Steam Separator Water—The quantity of water from the steam separator shall be weighed.

Boiler Water—The quantity of condensate from the condenser under Test Method *A*, or the feed water under Test Method *B* shall preferably be weighed. The weighing scales required will vary with the output of the boilers. The use of calibrated measuring tanks is not forbidden. All weighing scales shall be periodically tested for accuracy.

Feed-Water Temperature—The feed-water temperature shall be measured by a thermometer inserted in the feed-water line and located before the boiler-feed valves.

Flue-Gas Temperature—It is recommended that thermocouples, in preference to other types of thermometers, be used to measure the flue-gas temperature. The temperature shall be measured in the stack flue about one pipe diameter before the stack damper. The thermo-junction, or bulb of the thermometer, shall be located at the center of the pipe.

(It is recognized that the arrangement specified will not assure the temperature measured as being the true average of the flue-gas temperature. To obtain the true temperature it would be necessary to take greater precautions and a number of measurements over the cross section of the flue, both for gas temperature and gas velocity, and also to make allowance for the lowering of the recorded temperatures due to the couple points or thermometer bulbs "seeing" surfaces being cooler than the gases. The method specified is arbitrary and should give equally correct values at this high rate of boiler output.)

(Copper-constantan couples of 0.025 in. diameter are suitable for these measurements, and can be used without any protecting cover over the couple end. A convenient method is to use special double-hole porcelain tubing and uninsulated wires; for large diameter pipes the porcelain can be encased in a supporting tube, leaving 2 in. bare porcelain at the hot end.)

(The instruments used with the couple should be sensitive to at least 5° F. and a range up to 1000° F. should be sufficient. If a temperature recorder is used its accuracy should be tested periodically and its time scale should be not less than one scale inch per hour.)

Smoke-Hood Draft—The smoke-hood draft shall be measured at at least one pipe diameter before the stack damper. The readings shall be taken on an inclined U-gage. The draft value reported shall be an average of the maximum individual readings, none of which shall be taken when firing or when adjusting dampers.

The connection into the stack shall have its end square and set parallel to the pipe surface. A ⅛-in. iron pipe is a convenient size.

The gage used should be checked frequently for accuracy.

(This draft measurement is important because it is the draft value which is needed to determine the chimney size, which must be large enough to take care of the maximum output.)

CO_2 Percentage—The sample for gas analysis shall be taken from the smoke pipe within 1½-in. pipe diameters of the stack damper, and shall be collected so as to give a fair average sample of the gas stream.

(This is best done by using a ¼-in. iron pipe with a closed end and inserting it so as to reach to the center of the pipe. Holes ⅛ in. diameter are drilled on one side of the pipe so as to have not less than 4 holes in the radius length, and so spaced that each is at the center of equal cross-sectional areas of the pipe. If an open-ended pipe is used its end should reach to about the center of the pipe radius.)

(Since an average value for the test period is required the simplest method is to collect samples of the flue gas at a constant rate into a bottle, and to analyze these samples. Each of such samples shall be collected for the same length of time, and their values averaged.)

An Orsat or equivalent gas analyzer shall be used.

It is recommended that an indicating CO_2 meter be also used. A knowledge of the CO_2 value at any time will enable damper adjustment to be made more correctly.

PRELIMINARY RUNS

Preliminary runs will be necessary to find the setting of dampers under which

the limiting conditions of priming, smoke-hood temperature and CO_2 and CO percentages will not be exceeded.

(The expeditiousness with which this can be done and the possibility of duplicating results will depend on the skill of the operators and on the ability to set the dampers in definite positions; also somewhat on the constancy of the leakage through doors as they are opened and closed. The use of indicating or recording instruments will make this preliminary adjustment easier. Since the official test is to be the averages for the test period a knowledge of the relationship of instantaneous values of output, smoke-hood temperature, and CO_2 percentage to the time since firing will permit of the period of a preliminary run at any one setting being made shorter.)

OFFICIAL TEST

The boiler should have been under load for at least two hours previous to the start of the test. It should have been delivering the approximate correct output for at least thirty minutes and the rate of water feed adjusted to keep the water at its normal level.

Firing and Attendance—The conditions of firing and attendance that the boiler being tested would receive in service when it is called upon to deliver its maximum load should be simulated.

There is no restriction on the adjustment of damper during the test if this be found necessary to keep the average values of smoke-hood temperature, CO_2 and CO percentages within the specified limits.

The only restriction of firing is that the pounds of fuel per square foot of grate area fired at any one time shall not be less than 20 for anthracite and coke, nor less than 10 for bituminous coal.

The number of firings necessary during the official test will vary with the size of boiler. The only restriction is that the boiler must be fired with at least 20 lbs. of fuel per square foot of grate previous to the end of the first half of the official test time. Any unnecessary firings or permitting the fuel bed to get too thin will react by lowering the output obtainable with its limiting conditions.

Duration of Tests—With Test Method *A*, using a condenser, the official test period shall be not less than three hours.

With Test Method *B*, weighing the feed water, the official test period shall be not less than four hours.

Test Observations—Since a running start and running finish method is used, and since the period of test called for is short, care is necessary that the time of start and finish and the observations going with them are made with accuracy. Since there is no necessity to keep to the exact period specified, the actual times should be recorded and their difference used for the period of the test. As far as the number of men available are not sufficient to permit all the manipulation being made at the same moment, then they should be in the same order at the finish as at the start. It is advisable to time from the moment of taking the first and last water reading.

The manipulations and readings required are:

1. Adjustment of rate of water feed so as to keep water level constant.
2. Fuel fired. Time at which each firing is made and the weight fired should be recorded.
3. Weight of water condensed for Test Method *A*, or fed for Test Method *B*. If the test equipment is large enough, this will only require observations at the start and finish.
4. Weight of steam separator condensate. Only the total need be weighed if the equipment permits of it.
5. Feed-water temperature. The number of observations necessary will depend on its constancy.
6. Steam pressure. It is recommended that a pressure of 2 lbs. be maintained in the boiler.
7. Smoke-hood temperature.
8. Smoke-hood draft.
   Observations of 5, 6, 7 and 8 shall be made every 10 min.
9. Gas analysis for CO_2, O_2 and CO.

ADDENDA

On June 1, the council of the society met at West Baden, Ind., and received the report of the society's Committee on the Code for Rating Low-Pressure Heating Boilers for presentation at the 33rd semi-annual meeting at White Sulphur Springs, W. Va. The following suggested additions were made for the committee's approval.

In detail the additions recommended appear in the following paragraphs and are printed in italics for convenience in comparison.

RATING DEFINITION

Item 2—To read: The average temperature *for any hour* during the period of test of the flue gases leaving the boiler shall not exceed 700° F. . . . Eliminate Item 4 referring to CO.

STANDARD RATINGS

Take out reference to coke by elimination of second sentence, first paragraph. Under the item *Anthracite* have the last sentence read: There shall be no limitation to size of fuel permissible *but the size must be stated.* Omit the paragraph on *Coke.* The item *Bituminous Coal* to read: The coal to be used in bituminous rating tests shall be *a free-burning coal* having by proximate analysis *at least 30%* volatile matter content on a moisture and free-ash basis. *There shall be no limitation to size of fuel permissible but the size must be stated.*

SPECIAL RATINGS

The first sentence should be mandatory, substituting *must* for should, and it is believed that the word *codes* should be ratings.

RATING DATA

Item 2—Rating Output to be given in *B.T.U. and square feet.* Item 3 should read: Draft required expressed as inches of water *and the* chimney size *and height* necessary.

TEST SET-UP

The last sentence in paragraph *Smoke Flue*: This distance, not including the connecting box, shall be not less than *three* nor more than four times the equivalent *smoke* pipe diameter. Insert the following: *There shall be no check-draft damper on the stack side of the flue damper nearer to the flue damper than four diameters of the smoke pipe.*

MEASUREMENTS AND INSTRUMENTS

The last sentence under paragraph *Feed Water*: Two *needle* valves in series or parallel to facilitate the control of the water level. Then under *Flue-Gas Temperature*: The temperature shall be measured in the stack flue *two* pipe diameters *from the smoke collar on the boiler.* Make the last word of the final sentence *smoke pipe.* In the third explanatory paragraph have the first sentence read: The instruments used with the couple should be sensitive to at least 5° F. and should have a range up to not less than 1200°. The item *Smoke-hood draft* should read: The smoke-hood draft shall be measured at *two* pipe diameters *from the smoke collar of the boiler.* The readings shall be taken on *a calibrated* inclined U-gage. The next paragraph will read: The connection into the stack shall have its end square and shall be set *at right angles to the flow of gases.* To explanatory sentence add chimney size and height, omitting last clause beginning *which must be, etc.* The item CO_2 percentage first sentence should read: The sample for gas analysis shall be taken from the smoke pipe *at two* pipe diameters *from the smoke collar on the boiler, etc.*

PRELIMINARY RUNS

Eliminate reference to CO.

OFFICIAL TESTS

First paragraph to read as follows: The boiler *shall* have been under load for at least two hours previous to the start of the test. It *shall* have been delivering the approximate *maximum* output for at least 30 minutes and the rate of water feed *shall have been* adjusted to keep the water at its normal level. In the paragraphs under *Firing and Attendance* leave out reference to CO and coke, also make the second sentence of the fourth paragraph read: The only restriction is that the boiler must be fired with at least 20 lbs. of *anthracite, or 10 lbs. of bituminous* per square foot of grate previous to the end of the first half of the official test time. Under *Duration of Tests* add *or measuring* after the word weighing in second paragraph. In the item Test Observations, Number 5 should read: The feed-water temperature *shall not exceed 80° F.* Number 9 eliminate reference to O_2, CO. In Test Data Form make No. 2, Grate Area; in Nos. 13 and

14, substitute *flue gas* for smoke hood; omit Nos. 16 and 17 referring to CO and O_2. Make substitution in Formula of Computation of Ratings to conform with revised numbers in tabulation.

In line with the suggestions relating to the Code, the committee's explanation and interpretation would necessarily need slight revision, omitting those paragraphs relating to CO limitation, also the paragraph concerning Coke and the two paragraphs relating to Bituminous Coal. Again in the Manufacturers' Catalog Data the final paragraph to be revised as follows:

This code will enable the purchaser to select any boiler with confidence that all boilers are rated on the basis of the same maximum capacity. The committee does not consider it advisable at this time to suggest just what percentage of the maximum capacity-rating should govern the selection of any boiler in order to obtain maximum efficiency. This remains to be determined by experience.

Process Steam and Its Application

By Morris A. Hall, M. E.

IN its earliest application steam was used in power producing units. Later, the advantage of utilizing the heat in the steam instead of the expansive force was seen and steam heating was born. As investigators progressed with the experiments, the steam engine or power people gradually increased their pressures, while the heating people found that manifest advantages in their systems laid in just the opposite direction.

Thus, to-day we have the two general divisions of the uses of steam, as well as the pressures of steam; that for power application is usually considered as high pressure and runs anywhere from 100 lbs. gauge to 350 lbs. gauge, or even higher, while that for heating runs from, say, 10 lbs. gauge down to 20 in. of vacuum, with the preference for the least pressure possible. But between the two extremes lies a neutral ground—a sort of no-man's land—where intermediate pressures apply and in a zone commonly termed "process steam."

To a large extent this field has been neglected by the manufacturer and investigator alike; but now, it is suddenly being realized that the scope of this field is of no mean importance and it is encouraging to note how the industry is taking hold of the matter.

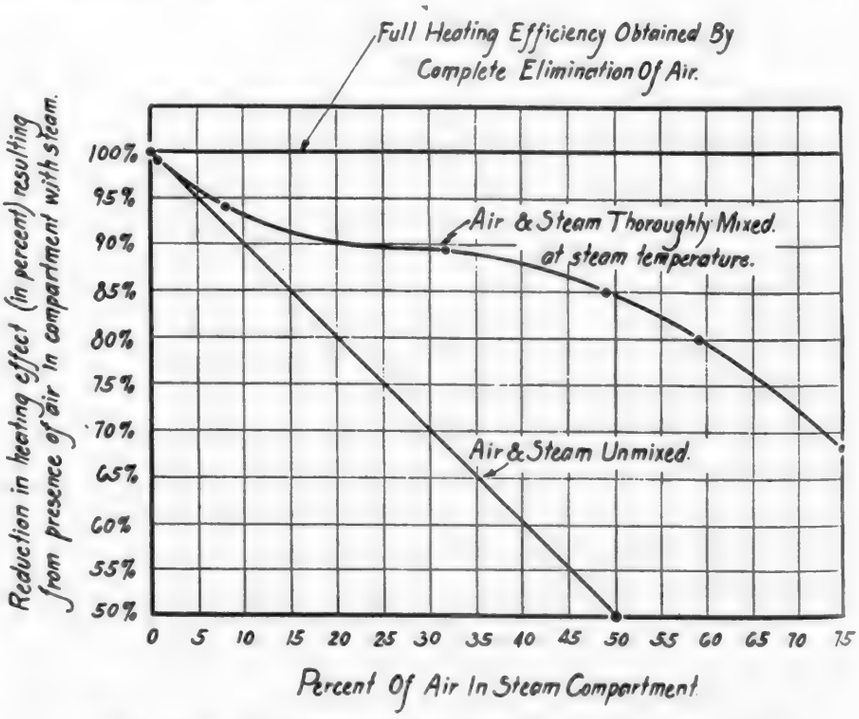
Process steam is used to a large extent in almost every industry of a manufacturing and chemical nature, in hospitals for sterilizing purposes and in laundries, to say nothing of experimental purposes in schools, colleges and other institutions. The pressures of such systems run anywhere from 10 to 100 lbs. gauge and for a long time the contractor has been left pretty much on his own as to how he shall install lines for this purpose, and accurate information as to the really necessary requirements has been largely conjecture.

There is no particular problem in handling process steam distribution and the supply is easily furnished from the so-called high-pressure systems through the medium of one or more pressure-reducing valves which may be adjusted to furnish any pressure desired within the limits specified. It may be said, as a general statement, that the success of the distribution system rests upon proper grading and the necessary removal of air and condensation from the distribution lines. In this respect process steam resembles heating steam and the difference lies in the fact that the ordinary specialties designed for use on the ordinary steam heating system, in a great many cases, are unable to stand the higher process steam pressures.

The accompanying chart graphically illustrates how the efficiency of any apparatus falls off with air retained in the lines and delivered to the apparatus along with the steam. Air elimination, therefore, is the crux of the matter and, so long as air pockets exist or the air is not entirely relieved, satisfactory operation cannot be expected or obtained.

Of course the elimination of condensation also is a very necessary attribute and this should be considered in relation to economy, for, if the condensation is allowed to escape at a very high temperature, a certain amount of heat is carried off with the water. Traps operating on the bucket, or float, principle, discharge water from process steam lines very effectively, but traps operating on the thermostatic principle will be found to discharge water at lower temperatures and will give satisfactory service if built to withstand the pressures to which they are applied.

From the foregoing it will be seen that the treatment of process steam distribution lines does not differ materially from that of low-pressure heating mains, inasmuch as they must be pitched so as to drain, must have the condensation removed, and must have the air relieved. The chief difference lies in securing and using specialties and accessories designed for these higher pressures. No doubt, such accessories will appear on the market in greater number and variety as time passes and as the possibilities of process steam are more widely realized.


Full Heating Efficiency Obtained By Complete Elimination Of Air.
Air & Steam Thoroughly Mixed at steam temperature.
Air & Steam Unmixed.
Reduction in heating effect (in percent) resulting from presence of air in compartment with steam.
100%
95%
90%
85%
80%
75%
70%
65%
60%
55%
50%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75
Percent Of Air In Steam Compartment

Effect of Air on Heat Emission from Steam Container Based on Atmospheric Pressure Inside Container

Donnelly Systems Company Liquidated

Announcement was made recently by Warren Webster & Co., Camden, N. J., manufacturers of Webster systems of steam heating, that they had acquired the inventions of James A. Donnelly and the physical assets of the Donnelly Systems Co., of New York. The business of the latter company has been liquidated. Orders for repairs and replacements to existing installations of Donnelly systems will be taken care of from the home office of Warren Webster & Co., at Camden, N. J.

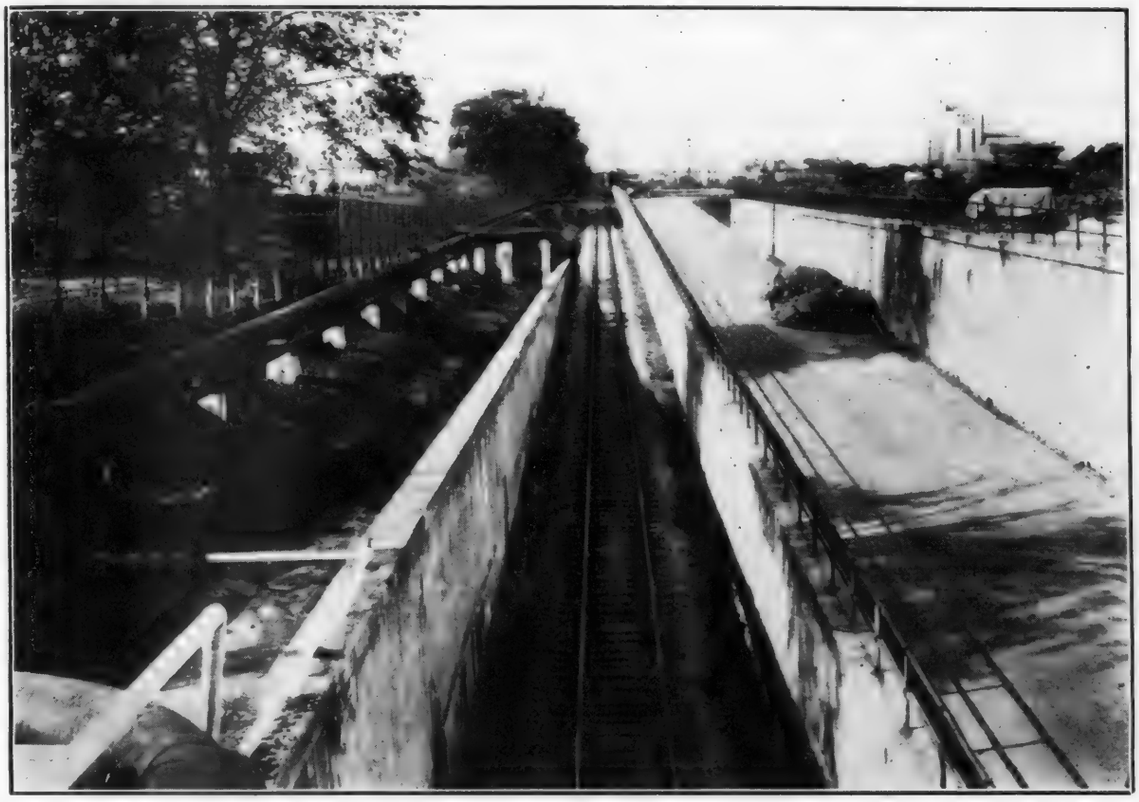


Fig. 1. The Use of Expansion Joints in this Aerial Steam Line Would Have Eliminated These Pipe Bends with Their Supporting Piers

Applications of the Modern Expansion Joint

How These Devices Compare with Pipe Bends in Solving Piping Problems Both Above and Below Ground

By Harold L. Alt

EXPANSION joints have met a very decided want in piping work, especially in underground lines which are carried in pipe trenches or tunnels. On the basis of space conditions alone, expansion joints often are an absolute necessity. Combined with this is an element of economy, due to the saving of pipe, pipe covering and trench work, as well as the shortening of the length of run.

There seems to be a deep-rooted dislike of expansion joints on the part of many engineers and contractors and it is problematical how much of this really is justified and how much is purely prejudice caused by some unfortunate experience. If it is a fact that expansion joints can give excellent satisfaction under some of the most trying conditions, then it is time to lay prejudice aside and to secure the benefits and economies possible by their adoption. It is the purpose of this article to demonstrate the conditions where expansion joints are peculiarly suitable and the advantages which are obtained by their use. The photographs are typical of piping conditions constantly met with in ordinary practice and are furnished through the courtesy of the American District Steam Company.

COSTLINESS OF PIPE TRENCHING

As is well known, underground lines conveying heated liquids or gases must have provision made for expansion and one of the elemental features of such work is the enclosing of the line, or lines, in some sort of a tunnel, trench or conduit for the purpose of keeping the earth away from the pipe. This not only leaves the pipe free to move as expansion dictates but also permits the application of pipe covering or insulation of some kind and assists in the draining away of ground water. The construction of enclosures for underground lines is at all times a more or less expensive proposition and, consequently, apparatus or devices that reduce this expenditure are a real economy.

PIPE COVERING ALSO AN EXPENSIVE ITEM

The next most important item, as far as cost goes, is insulation; in long runs of pipe the amount of heat wasted and water produced by condensation rises to a considerable amount. Every legitimate means to conserve these losses is justified and even demanded on the ground of economical operation. A reduction in the length of run aids this conservation from two angles; a shorter run means less condensation and a shorter length of pipe to be covered as well.

PIPE BENDS INVOLVE EXTRA COST AND SPACE

As the only way to take up expansion, outside of the use of expansion joints,

Fig. 2. Typical Example of Pipe-Bend Construction on Underground Line, Showing Additional Excavation Required, as Well as Pipe Lengths and Covering

is by means of swing joints, offsets or pipe bends (including spring pieces) the cost of such methods must be considered; such cost is made up of the additional pipe and pipe fittings involved, together with extra hangers, some of which may need to be of special type. Besides this is the amount of additional space needed to accommodate such devices. This space may be available in some cases and in others may be secured only with great difficulty, if at all.

FRICTION IN THE PIPE LINE

Every designer knows how the pipe friction begins to build up in lines over 1,000 ft. long and how the pressure drop, which is the direct result of this friction, begins to require larger and larger sizes of pipe as the run is lengthened. If provision for expansion is made every 200 ft. or so, it can be seen that there will be about five take-ups in every 1,000 ft. of line and the additional length of pipe introduced begins to make itself felt.

EXAMPLE OF AN AERIAL STEAM LINE

A typical example of how take-ups must be treated when expansion joints are not used is shown in Fig. 1 which is a photograph of an aerial steam line run along the railroad tracks by a large manufacturing company and involving pipe bends and special supporting piers at regular intervals. The use of expansion joints in this case would have permitted the installation of one straight and continuous pipe line, with a corresponding saving in piers, pipe and covering. Owing to the fact that this line has no trench or tunnel construction, the possible savings are not as great in this particular instance as they would have been with underground construction.

In Fig. 2 is shown another example of the same type, of some underground construction installed for a university in which the campus provided ample space to permit this type of provision to absorb the expansion. The additional length of pipe there installed requires no additional comment.

SIMPLICITY OF EXPANSION JOINT IN TRENCH WORK

How the use of an expansion joint will simplify and facilitate trench work is demonstrated in Fig. 3, where a large line is being installed and the expansion joint is ready to be inserted in the line; the joint itself will be noted at the left of the pipe and a slight enlargement of the concrete base slab will be observed. This is for the future construction of a manhole at this point to provide for access to the joint, if necessary; as far as space is concerned, there is very little more required over that necessary for the trench alone.

Another example of underground work is given in Fig. 4 where two lines are illustrated with the expansion joints already in place. This photograph is of actual work being installed in Jackson, Mich.

EXPANSION JOINTS ON AERIAL LINES

Near the Harbor Point Power Plant at Utica, N. Y., a very large size line was run at grade level and expansion bends or swing joints for such a proposition would have been almost unreasonable, owing to the extreme length and size of pipe required, as well as the additional territory which would have

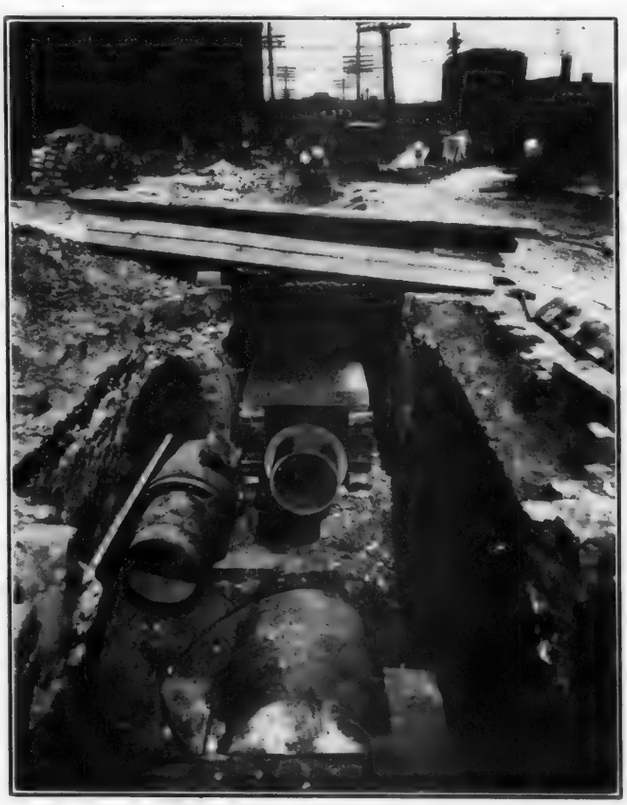


Fig. 3. How Expansion Joints Simplified and Facilitated Trench Work in a High-Pressure District Steam Main in St. Louis

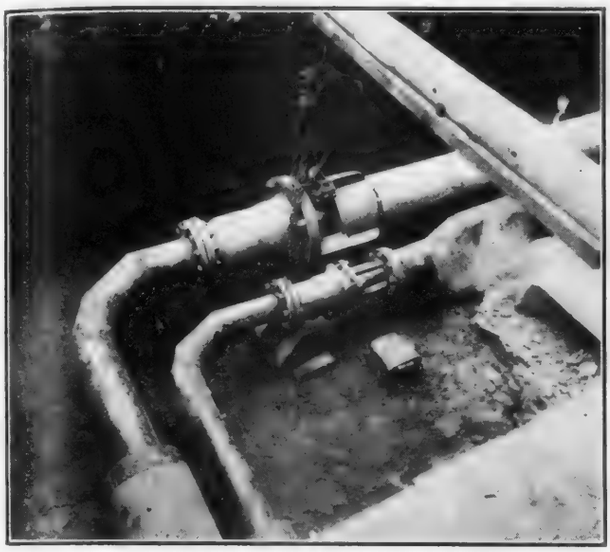


Fig. 4. Expansion Joints in Place in a 6-In. High-Pressure Supply and a 4-In. Return Main

Note welded angle turnout from service connection.

been needed to accommodate these devices. Fig. 5 shows how this difficulty was solved with the minimum amount of room and a considerable saving in cost by the use of an expansion joint to take up the movement.

DIFFICULTIES WITH PARALLEL LINES

Where several lines are run parallel, such as a steam line, a return line and a drip line the difficulties arising in trying to use expansion joints or swing bends are aggravated to a considerable extent. It is usual, in such cases, to make the bend or swing joint to suit the largest pipe and then to try to bring the bends for the smaller pipes in such a way as to fall inside the largest pipe bends. This frequently involves a certain amount of juggling of the pipes and may result in an arrangement far from ideal even at the best. How this may be accomplished with the minimum amount of difficulty is illustrated in Fig. 6, which shows three parallel lines with expansion joints installed in each line in the lower left hand corner of the picture.

EXPANSION JOINTS IN BUILDING WORK

While expansion joints have been developed particularly for underground lines, the development of these devices has led to their adoption in building work, especially in restricted quarters. In high buildings especially, where long vertical lines are carried up in comparatively small pipe shafts, it is almost a necessity to use some means for taking up expansion which does not require valuable space to enclose the device. Here the expansion joint fills a long-felt want, and when the designer discovers how such a joint relieves him from a world of difficulties in the shafts, he is not slow to apply the same solution to the risers and, ultimately, to the horizontal mains.

In Fig. 7 is shown a typical application of the expansion joint to building work. In this case a double slip joint, located on the basement ceiling, is taking the pipe expansion from both directions.

USE OF EXPANSION JOINTS ON HIGH PRESSURE

One of the first questions that suggests itself in regard to expansion joints is the one, "Are they tight?" and its corollary, "If tight when installed, how long will they remain so?" On this point it might be stated that expansion joints have been applied with success on lines carrying pressures up to 125 lbs. gauge, or higher, and with temperatures reaching 900° F.

Fig. 5. Steam Line of the Utica (N.Y.) Gas and Electric Company, Showing Two Expansion Joints, With Method of Anchorage

Fig. 6. Three Parallel Lines With Expansion Joints Installed in Each Line

Fig. 7. Typical Application of Expansion Joint to Building Work

Heating Plants as Fixtures

By John Simpson

3. As Between Landlord and Tenant

As between landlord and tenant the rule is much more relaxed in favor of the tenant. While the mode of attachment to the realty and the apparent intention of the parties may show that a heating plant installed by the tenant is intended to remain as a permanent improvement, the circumstances of the case and the nature of the premises, as in the case of business premises and hotels, may make them "trade fixtures," removable by the tenant before the expiring of the lease, provided such removal does not result in material and permanent injury to the freehold. Northwestern Lumber & W. Co. v. Parker, 125 Minn. 107.

As between lessor and lessee a boiler required to run the elevator engine and furnish steam for heating a commercial building, placed in a vault under the sidewalk on a brick foundation and bricked up on each side, and which could only be removed by taking up the sidewalk, the elevator and steam heating apparatus having been put in as part of the original construction under the lessee's contract, was held to be a part of the building and of the real estate. It was supplied for the use of the building, was fairly included in the description of a first-class commercial building, could not be removed without substantial injury to the structure, was within the reasonable contemplation of the contract, and was a part of the very expenditure which the lessee was bound to make and the lessor was entitled to receive. Under the contract the lessee agreed to erect and did erect the building, half the cost to be paid by the lessor in case he determined not to release the premises at the expiration of the term of 25 years. The lessee was dispossessed for nonpayment of rent about five years after erection of the building. In an action for rent due the lessee's counterclaim for one-half the value of the building and for the value of the elevator and boiler was held untenable. Finkelmeier v. Bates, 92 N. Y. 172.

A steam heating plant, including a six-section boiler and pipes, radiators and other appurtenances, used to heat the living rooms and hall of a building used as a hotel and saloon, were held not trade fixtures, and not removable by the tenant. Levenson Wrecking Co. v. Hillebrand, 93 Misc. (N. Y.) 530, 157 N. Y. Supp. 515.

As between landlord and tenant a steam heating plant consisting of boiler, pipes, radiators and valves installed by the tenant of a factory building whose lease required him to make repairs at his own expense and leave the premises in good condition, was held a fixture not removable by the tenant as a trade fixture at the end of the lease, where the removal would cause serious injury to the building and the plant was peculiarly adapted to the use of the freehold. Jacob v. Kellogg, 56 Misc. (N. Y.) 661, 107 N. Y. Supp. 713.

This case was followed in McOwen v. Zimmerman, 133 N. Y. Supp. 161, holding that a steam heating apparatus, including a heater, two radiators, and the necessary piping, coil and tanks to complete a steam heating plant for use in a building used for store and office purposes, were part of the realty and not removable as trade fixtures by the tenant.

A furnace with hot air flues, put in by the tenant to heat his store, was held to be an improvement within the meaning of a lease providing that improvements should belong to the landlord, although the furnace and flues could have been removed. Parker v. Walstein, 48 N. J., Eq. 94.

And in Palmer v. Young, 108 Ill. App. 252, a lessee was enjoined in a suit by the incoming tenant from removing a steam heating plant and its radiator.

A steam heating and power plant in a two-story and basement building, consisting of engine, boiler and pipes, nailed or screwed to floor joints and coil radiators in the basement and the usual steam radiators on the first and second floors, with the usual elbows, couplings, valves, traps and fittings incident to a steam heating plant was, as between landlord and tenant, held a fixture, its mode of annexation, its nature and its purpose and use being such as to place it within the class of permanent improvements, and its removal could not be effected without substantial impairment of the freehold.

As between vendor and vendee, or mortgagor and mortgagee, there could have been no doubt the plant was a fixture, being substantially attached to the realty. It could not, it was held, be excepted from the rule as a "trade fixture" because its removal would substantially impair the freehold. Northwestern Lumber & W. Co. v. Parker, 125 Minn. 107, 145 N. W. 964.

BOILER A FIXTURE BUT SCREWED PIPING REMOVABLE

A boiler was held to be a fixture as between landlord and tenant, because it was not easily removable; but the hot water pipes, connected merely with screws, were held not mere adjuncts of the boiler, but removable by the tenant. Jenkins v. Gething, 2 Johns. & H. (English) 526.

As between landlord and tenant, a furnace, about three by four feet, erected in the basement by the tenant for heating the house, consisting of an iron stove, with grates, pipes and ventilators, which could not be removed without to some extent injuring the house, became a part of the freehold and was not removable by the tenant at the termination of the lease. Stockwell v. Marks, 17 Me. 455.

HEATING PLANTS AS "TRADE FIXTURES"

In the case of hotels and business premises in general, as has been said, heating plants installed by lessees are usually regarded as "trade fixtures."

A sublessee of a hotel put in a steam heater and boiler for the convenience of the business and trade. The question being submitted to the jury in an action by the lessee against the owners of the property for conversion of trade fixtures, the jury found in effect by their verdict that they were trade fixtures, subject to the right of removal during the term of the lease. Podlech v. Phelan, 13 Utah 335.

Tenants of a hotel, finding they could not get heat enough with the boiler then in the building, substituted one of their own with the announced intention of removing it before the lease expired. It was not attached to the walls in any way that did not permit its removal without injury to the building. It was held that it was not a fixture and was removable by the tenant. McLain Investment Co. v. Cunningham, 113 Mo. App. 519.

The lessee of a five-story business building installed steam pipes for radiation on the second, third and fourth floors. At the end of its lease the trustee of its estate notified its successor in the tenancy of his ownership of the steam pipes, suggesting the new tenant purchase them. This offer not being accepted, the trustee took down the radiation and sold it. The new tenant sought to recover against the landlord as a counterclaim in an action for rent, the loss it had suffered because of the removal of the heating pipes. The Michigan Supreme Court held, Lovett v. Bermingham-Seaman-Patrick Co. 192 Mich. 372, 158 N. W. 881, that the steam pipes did not pass to the new tenant under its lease. The court apparently held the pipes were not part of the realty which would pass by the lease, but fixtures belonging to the former tenant and removable by it, under the definition of "fixtures" under the bulk sales law, i.e., "trade fixtures," as given in Bowen v. Quigley, 165 Mich. 337, 130 N. W. 690: "Such chattels as merchants usually possess and annex to the premises oc-

cupied by them, to enable them the better to store, handle, and display their goods and wares.... They are generally removed without material injury to the premises."

As between the landlord and the old tenant, the court said, there could be no doubt that the old tenant had the right to remove the pipes upon the expiration of its lease, it being the unquestioned owner thereof; and it followed that the title to them did not pass to the new tenant as part of the realty by its lease.

HEATING PLANT REMOVABLE WHEN THERE WAS NO APPRECIABLE INJURY TO BUILDING

As between the landlord and tenant of a theatre building, the evidence in a suit to enjoin the tenant from removing a steam heating plant placed in the building by the tenant with the landlord's consent showed that it could be removed without appreciable injury to the building or to the plant. The boiler was not attached to the building except by the steam pipes, which were suspended by hangers and at the places where they were connected with the radiators, passed through small holes in the floor. These holes were the only injury which would result to the building. It was held that the plant was removable as a trade fixture under the general rule that the tenant may remove trade fixtures within the term of his lease if they are capable of being detached without material injury to the freehold or to themselves and of being set up and used elsewhere. Newcastle Theatre Co. v. Ward, 57 Ind. App. 473.

A hot-water furnace furnishing heat to a greenhouse, itself a mere temporary structure, removable without injuring the realty, was held a trade fixture, and removable, in Royce v. Latshaw, 15 Colo. App. 420, 62 Pac. 627.

In a Canadian case, Gardiner v. Parker, Ont., 18 Grant's Ch. 26, a heating plant for a greenhouse was held not to be a fixture as between landlord and tenant, and removable.

WHEN RADIATORS WERE REMOVABLE

Radiators placed by a tenant in premises leased to him for use "as a saloon or lawful place of amusement and for dwelling purposes," not so affixed to the realty that they could not readily be removed, were held to be "trade fixtures," which the tenant was entitled to remove.

"Trade fixtures" were defined to mean property placed by a tenant on rented realty to advance the business for which the realty was leased, and which may, as against the lessor and those claiming under him, be removed at the end of the lessee's term. Webber v. Franklin Brewing Co., 123 N. Y. App. Div. 465, 108 N. Y. Supp. 251.

The difficulty of applying the recognized rules as to what are fixtures and not removable and what are "trade fixtures," removable by the tenant who installed them at the end of his term, is illustrated in a very recent Canadian case, Coleman v. Monahan, New Brunswick Supreme Court, Appeal Division (1927), 2 D. L. R. 209, in the opinion of which Grimmer, J., cites several cases decided in the United States courts.

The tenant of a hotel had, with the landlord's consent, installed in the basement two boilers and a jacket heater to heat two adjoining buildings which he had leased for his hotel business. The boilers were not attached to the premises in any way, but rested by their own weight on a concrete foundation in the cellar, their only connection being with hot-water pipes to which they were attached by couplings capable of being easily unscrewed without damage to the freehold. This new heating system had nothing to do with the hotel itself, which had its own independent system when the building was leased, except to heat two radiators in additions made to the premises. At the end of the lease the tenant removed the boilers and heater. The landlord sued for waste, conversion and breach of a covenant in the lease providing that all interior repairs and any improvements to the premises should become part of the realty and the property of the lessor.

The question in the case was whether the boilers and heater passed to the landlord under the terms of the lease. This, the court said, was to be determined by reference to the words of the lease, the nature of the articles, and the intention of the parties at the time they were installed.

The courts find it difficult to lay down any very general rule on the subject, being necessarily "guided in great measure by the circumstances of each case, the nature of the article, and the mode in which it is affixed. The rule has always been more relaxed between landlord and tenant than as between persons standing in other relations." For many years it has been held that stoves are removable during a term.

It was held that the boilers were chattels belonging to the lessee which he had a right to remove. They were installed with the landlord's consent for special purposes made plain to him at the time; they were not used as a part of the hotel heating system, nor essential in any way for the heating of the hotel. They were not affixed in any way to the freehold by bolts, screws or posts let into the ground and could be removed without injury to the freehold.

The court, although it did not expressly say so, apparently regarded the articles as "trade fixtures."

REMOVAL MAY BE QUESTION OF FACT FOR JURY OR TRIAL COURT ACTING AS JURY

The question whether, as between landlord and tenant, a heating plant or a part thereof is a fixture and part of the realty or a "trade fixture" and removable by the tenant, may be a question of fact for the jury, or the trial court acting as jury.

The tenant in possession of mortgaged premises, put in a boiler for the purpose of heating the building and running a laundry. A mortgagee who had foreclosed the mortgage sought to have the plant replaced, complaining that the tenant had dismantled it, disconnected the pipes and radiators, removed the boiler from its foundation, and removed most of the radiators, steam pipes and steam fittings from the building. The petition was dismissed by the trial court. The tenant claimed that he had instructed the contractors not to fasten anything down as he did not want the plant put in permanently. The evidence on the question whether the plant was put in for a temporary purpose and in a temporary manner being extremely conflicting, the Nebraska Supreme Court refused to interfere with the trial court's finding, president, etc., of Insurance Co. of North America v. Buckstaff (Neb.) 92 N. W. 755.

In an action to enforce a mechanic's lien for labor and material furnished in putting a heating plant into a building under a contract with the lessee, the question was whether, as between the lessors and the lessee, the plant became a part of the realty. It appeared that the plant was substituted for a prior one belonging to the lessors. It consisted of a steam boiler set in and on a cement and brick foundation on a cement floor, encased in brick masonry in the basement, and screwed to steam pipes running along under the floor and through holes cut in the floor, and screwed to radiators resting on the floor in the first story, with automatic air valves attached to the radiators. The Minnesota Supreme Court held, Pond & Hasey Co. v. O'Connor, 70 Minn. 266, 73 N. W. 159, 248, that, even under the liberal rule applicable between landlord and tenant the trial court was justified in finding that the plant became a part of the realty.

Whether a hot-water heating plant installed by a lessee, consisting of furnace, boiler, pipes and radiator, was so affixed to the building as to become a part thereof and to be an "improvement" which, under the terms of the lease was to become the property of the lessor, was held a question of fact for the jury, which found for the lessee. Cohen v. Whitcomb, 142 Minn. 20, following Pond v. O'Connor, supra.

The total manufacturing production in the United States has increased about 65% in volume from 1914 to 1925, or at a rate about 3½ times as fast as the poulation, which has increased less than 18% during the same period, according to a study just completed by the National Industrial Conference Board, 247 Park Ave., New York. The production of our manufacturing industries per wage earner employed in 1925 was 35%, or more than a third, greater than in 1914, volume of production having far outstripped the increase in the number of workers as well as population growth.

The Future of Coal and Its Relation to Smoke Abatement

What Science Is Doing to Eliminate Objections to the Use of This Fuel in Ever Increasing Quantity

SMOKE is probably the greatest factor in determining the future status of coal as a fuel in congested centers of population. The smoke "nuisance" is becoming rapidly a smoke "evil" and far-seeing individuals in almost every locality are pondering on how this almost insurmountable objection may be overcome.

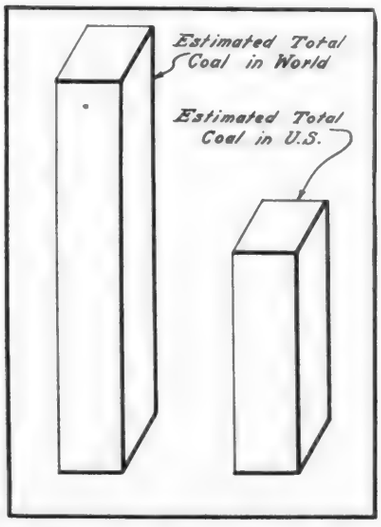
COAL DEPOSITS OF THE WORLD

The amount of energy in the *known* deposits of coal today is so tremendous as to almost be beyond imagination.

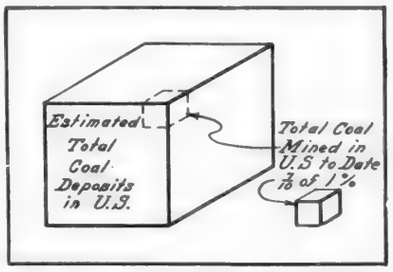
According to authorities in the U. S. Geological Survey the total remaining coal supply in the United States is 3,419 *billion* tons, while the amount recovered in mining operations conducted to date approximates 16.8 *billions* tons and including the waste occurring in mining represents a depletion of about 25 *billion* tons. This is graphically illustrated above.

While the figures quoted are admitted to be little more than a scientific guess, they would seem to indicate that the world's coal supply is not in any immediate danger of exhaustion, either in our own time or in that of our children's children.

About one-half of the total coal deposits of the world are included within the boundaries of the United States, while the total supply (as shown below) is evidently ample for the whole world. Although we have considerably more than our share in this country, this does not mean that our supply should not be conserved and used—when it is employed—in apparatus of highest possible efficiency.



We Have More Than Our Share of Coal



This Graphically Shows How Small a Portion of the Estimated Coal Resources Has Been Mined

PERCENTAGE OF HIGH GRADE

Another pertinent fact is that really high-grade coal constitutes only a very small fraction of the enormous deposits quoted. For this reason efforts must be made—not only toward smokeless utilization—but toward the development of uses for the more or less inferior grades, such as sub-bituminous and lignites.

GROWING SMOKE MENACE

But most important is the overcoming of the fast increasing smoke nuisance. As an example of what this may become, unless checked very soon, we have only to look across the water and see what has already happened in England.

London to-day is submerged in a combination of fog and smoke. Statistics show that in England—which is a comparatively small country as far as area goes—40,000,000 tons of soft coal are being burned annually in open grates.

Some action must be taken to overcome this evil and the day is not far distant when the situation is going to force its own solution by reaching such an acute stage as to be unendurable.

Scientific study is now being brought to bear on the subject and some progress has been made already along the line of producing from inferior coal a derived fuel which will be easy to handle, convenient to burn and which will ignite and consume smokelessly.

THE LIQUEFYING PROCESS

Most encouragement in this direction seems to be offered by the process of liquefying coal which was discovered by Dr. Bergius of Germany in 1913. This process has been perfected to a point where 40% to 70% of the coal treated can be transposed into oil by hydrogenation at high pressure. It is claimed that in this process a 2,000-lb. ton of coal (average bituminous) will give an approximate yield of 300 lbs. of gasoline, 400 lbs. of middle fraction (including kerosene), 120 lbs. of lubricating oil and 160 lbs. of fuel oil. Nearly all grades of coal and lignite (exclusive of anthracite) may be so treated and screenings are particularly desirable for the liquefying process.

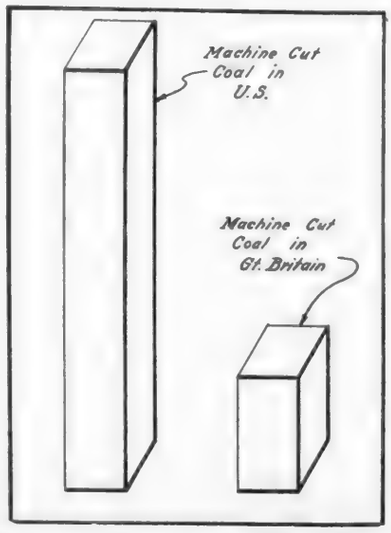
In this scheme the coal is heated up to between 400° and 500° C., at which temperature the compounds of high molecular weight, constituting the coal, are split up into smaller groups which are capable of combining with hydrogen to form a complex mixture of hydrocarbons quite similar to mineral oil.

DETAILS OF METHOD

The coal is first crushed to a medium fineness and mixed with a little oil obtained from a previous operation so as to form a thick heavy paste. This paste is forced at a pressure of 2,500 to 3,000 lbs. pressure through a retort where hydrogen is forced in at a similar pressure. Some of the hydrogen is absorbed by the coal.

In a second retort, heated to 420° C., most of the coal becomes a liquid by taking up more hydrogen; the unchanged coal is later removed and the liquid separated into motor fuel, Diesel oil, lubricating oil, pitch and other products.

Besides the process of liquefying coal there are several other solutions being investigated to find out what can be accomplished through the process of low-temperature carbonization. The University of Illinois is working along this



Mechanical Production of Coal Characterizes the U. S. Output

line and has been producing a good grade of coke suitable for domestic use.

Distillation at low temperature is another possibility to accomplish the same end. A plant in Fairmount, W. Va., produces briquets and low-temperature by-products, having treated, so far, about 22,000 tons of coal.

There also is the McEwen-Runge process, being tried out at the Lakeside Station of the Milwaukee Electric Railway and Light Company. This plant has a capacity of about 200 tons per diem.

POWER PLANTS AT THE MINE

The idea of locating power plants at the mine mouth as a means to utilize coal at its source has proved, upon careful investigation by competent engineers, to have various objections. In order to make such a proposition a practical and financially sound investment, three factors must coincide geographically. First, is the mine; second, is an abundant supply of water for condensing purposes; and, third, is a market in which to sell the current. This market must be in fairly close proximity to the power plant. Unfortunately, the desirable combination occurs but rarely.

PULVERIZED COAL

Pulverized coal is still another possibility and can be utilized in large plants; it does not lend itself, however, to smaller installations with equal facility. Pulverizing has not reached its limit as yet, for new discoveries are being made from time to time in connection with this process.

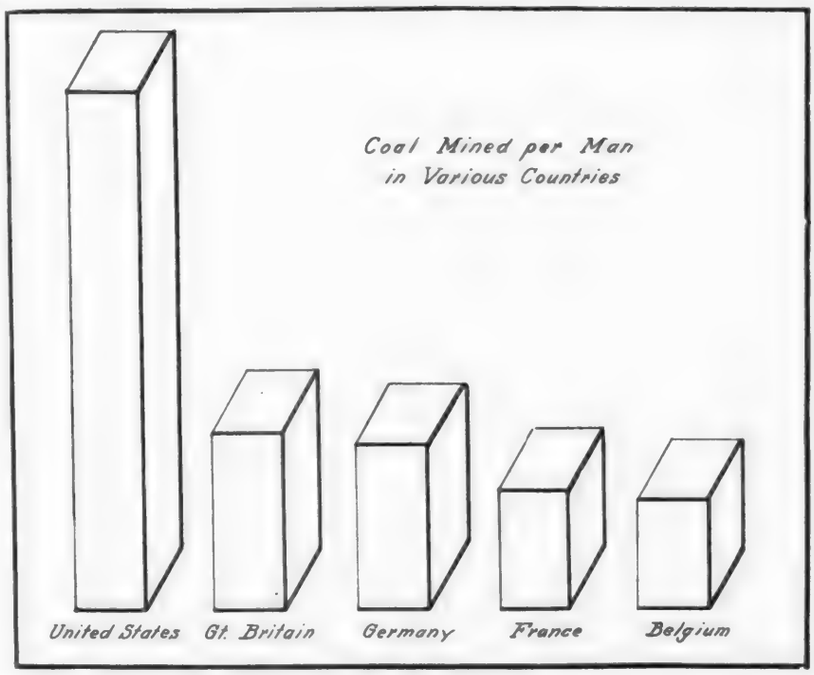
Recently it has been discovered that pulverized coal can be made sufficiently fluid for transportation in pipes without being mixed with air. This is accomplished by heating the pulverized product until the volatile portions begin to distill off, the vapors from the volatile matter taking the place of air in the pipes.

COST OF COAL

In connection with the so-called high prices of coal in America, compared with prices of a few years ago, there seems to be little justification for such complaint. More mining is being done by machine in this country than anywhere else and the tons produced per man is way in excess of other countries. For example, in Great Britain, for the year 1924, less than 19% of the coal mined was cut by machine while in the United States, for the same period, over 70% was machine cut.

COAL MINED PER MAN

The coal mined per man is as follows:—



Elaborate Mechanical Equipment Greatly Increases Output Per Capita Employed

Country	*Tons*
United States	734
Great Britain	246
Germany	234
France	167
Belgium	152

Even with the present "high" prices the claim is made that this essential fuel is being furnished here at the lowest mine prices of any country in the world.

AWAY WITH RULE OF THUMB appears on the cover of a circular issued by the All-America Standards Council, San Francisco, Calif., in which is advocated the adoption of the Metric system of weights and measures by the next Congress. In an accompanying news release the council predicts the passage of the necessary laws during the present year.

California Paves Way for Comprehensive Small Town Ordinances

The difficulties under which small towns and cities attempt to formulate ordinances for building construction and equipment installation are intensified by the prevalent prohibition against the adoption of ordinances or regulations by "title." That is to say, a city normally cannot adopt a uniform code prepared by the National Fire Protection Association merely by voting to accept this as the legal standard. It is necessary to print the entire document, as provided by law, in the daily papers, and this proceeding frequently is so expensive as to force those in authority to attempt the formulation of their own code, usually with unsatisfactory results. The following comment, from the Bulletin of the Pacific Coast Building Officials' Conference, marks the passage of a bill in California that should be decidedly beneficial, particularly to the smaller cities and towns:

"Legalizing the adoption of ordinances establishing rules and regulations for the construction of buildings, the installation of plumbing or electrical wiring and similar matters, Senate Bill No. 247, which was introduced in the senate by Senator Ralph Swing, of San Bernardino, was recently signed by Governor C. C. Young of California. This measure will be of great assistance to the smaller municipalities.

"The question of whether or not the adoption of regulations in ordinances by the method of reference was legal has been argued and disagreed upon many times in the past. The League of California Municipalities with its secretary, William J. Locke, sponsored Senate Bill No. 247 to clear up and eliminate the existing difficulty. As a result, it will now be possible for the smaller cities to readily avail themselves of complete and adequate building, plumbing and electrical regulations. Greater safety to the general public is bound to follow, since in the past the expense has been prohibitive for many of the smaller cities to adopt proper regulations.

"Senate Bill No. 247 reads:

"'The People of the State of California do enact as follows:

"'Section 1. Ordinances passed by cities or counties must be posted or published in a newspaper as required by their respective charters or the general laws; provided that ordinances establishing rules and regulations for such matters as the construction of buildings or the installation of plumbing or electric wiring, where such rules and regulations have been published as a code in book form, may adopt such code or portion thereof by reference thereto without further publication or posting, provided not less than three (3) copies of such code have been filed for use and examination by the public in the office of the clerk of such city or county, as the case may be.'"

Health and Ventilation

By Peter H. Bryce, M. D.

4. House Lighting in Relation to Health

IT is many years since, as a post-graduate student, the writer spent his first day in the Glasgow Royal Infirmary and witnessed six operations for knock-knees in rachitic children. It was only a few years before that time that the medical officer of health induced the town council to begin one of the first important works of public sanitation in Great Britain in the removal of old rookeries and the replacing of them by the Argyle Street Arcade. The reason for this work grew out of the repeated epidemics of typhus fever and cholera. Later, on medical duty in similar slums in the Canongate, Edinburgh, the writer climbed, with a feeling of horror, a dark, winding, stone staircase in a six-story building, many of whose rooms looked into dark, sunless courts, and in one of which lived a family of seven. Then, infant mortality was more than 25% of all births, and rickets and scrofula were the chief maladies brought to the Children's Hospital clinic. To-day, if such slums are permitted to exist in any city in America, it is not from lack of knowledge of the effects upon health of damp, dark, overcrowded apartments, or of the remedies which ought to be applied in such cases.

1. However, it has not generally dawned upon the public mind, that while the heating and ventilation of old buildings should be improved, the evils due to the absence of sunlight in living-rooms may often negative the effects of good food, heating and ventilation. The influence in town councils of owners of high-priced property in old cities and of land speculators in new districts, has often prevented the adoption of building by-laws, especially in the matter of the lighting of buildings. Here again the study of the lighting of a unit building is obviously the basis for investigating the lighting in all other buildings.

WHY THE LONG SIDE OF THE HOUSE SHOULD FACE SOUTH

2. It has already been suggested that the length of the house should be arranged to face south, thereby insuring to its rooms the largest amount of direct sunlight possible. We know to-day that sunlight has many other qualities besides the mere illuminating of space, and that while the sun's spectrum, visible to the human eye, only includes from the red to the violet rays, yet there are, beyond the red, longer light-waves of infra-red, increasing in length to the electric light waves. Experiments by physicists have shown that noonday sunlight has 75% of its total as infra-red or heat-rays, 15% of rays in the visible spectrum, and 10% as ultra-violet rays. Further, an incandescent electric bulb has 90% of its total as infra-red heat-rays, 9% of the visible spectrum and only 1% of ultra-violet rays. Yet carbon arc-lights can be made to approximate sunlight; while mercury arc-lights in a quartz envelope have ultra-violet rays even shorter than those of sunlight.

3. Further studies of the effects of various kinds of sun-rays have shown that from the biological standpoint, as affecting the growth of plants and animals, it is the ultra-violet rays nearest the violet, which are most beneficial and stimulating, and also that the ordinary window-glass does very largely obstruct the passage of these rays into the interior of rooms, and that it is the lack of sufficient exposure to direct sunlight, which is largely responsible for rickets in children and anaemia in older persons. Obviously, for most persons, daily exposure to sunlight in the open air is a cheap and practical remedy for such conditions.

4. Turning, however, to the problem of securing direct sunlight in dwellings, we have seen that the noonday sun supplied 75% of red and infra-red heat-rays, so that even in winter, in north temperate climates, it is possible to flood the house with warm sunshine for at least six hours daily. Indeed, the writer has in his dwelling a continuous south window of 18 sq. ft., warming a flower-room and wide hall and supplying the living-rooms with so much heat that in mid-winter the oil furnace may be turned off for hours, so balancing the loss of fuel through greater window radiation after sundown.

ARCHITECTS AND THE PUBLIC SHOULD REALIZE IMPORTANCE OF SUNLIGHT

5. That the importance of sunlight to-day is being recognized is seen in the fact that the report of the High School General Conference held at the University of Minnesota, begins with the statement, "General Science should be organized with reference to the environment in the everyday life of the child," and in a list of sixty-eight subjects in General Science the lighting of the house and schoolroom is placed third in importance. Hence, it seems most desirable to inquire what can be done to supply dwellings, where townspeople spend most of their lives, with such lighting as will mitigate, in some measure, the obvious effects of deficient sunlight.

We must, indeed, first educate the architects, as well as the public, in these scientific facts, since the writer can see from his window a second house being built in which, with abundant open space around, the architect has erected across the south end of the house a garage, thereby almost wholly excluding direct sunlight from the living-room. Assuming, however, the worst conditions, such as those of a city street with continuous rows of houses, where inside walls often open on courts receiving almost no direct sunlight, it is nevertheless possible to obtain a fair amount of reflected light in the rooms if the outer walls of the court are kept painted in white oil colors. The General Electric Company's Lighting Service states, in a pamphlet, that if all "the surfaces of a room were black with no reflecting power, the illuminating of any surface would be only that direct from the lamp." It further points out that a pure white surface is most suitable as a reflecting medium, a white gloss enamel paint reflecting 84% of the light. It is apparent that since most of this reflected sunlight has 75% of heat-rays, the fact is one that ought to be made full use of, even in the matter of heating.

6. Fortunately, to-day, for the ever-increasing proportion of the population, which is crowding to cities, modern Science, and most of all, Thomas Edison, has come to our aid in lessening the evil effects due to the lack of sunlight in our houses. In former days our forefathers worked hard, went to bed early, and were up at sunrise, and paid their devotions to the god of day, and in the fields received invigorating effects from direct sunlight and fresh air. But we of to-day must turn to the electric lamp to mitigate, to some extent, the results of having become in some measure urban troglodytes.

Thus, the steady even light from Mazda lamps, with their perfected internal frosting, or a number of electric bulbs, so arranged as to prevent shadows by indirect diffused light, are capable of supplying, even in a surgical room, light for the most delicate operations. Not only has success been attained in this difficult field, but it also has been found by exact experiment that, through adequate lighting, technical inspectors of delicate work can increase greatly both the accuracy and amount of work done in a given time. If these results are possible in such cases, how much more necessary should proper and adequate lighting be in the hundreds of thousands of houses, shops and factories where house-wives, clerks and operators are engaged, for long hours, in close work with their eyes.

7. The importance of sunlight, however, is being recognized also as a part

of school life. Everyone hears of the high proportion of school-children having defective vision, due in part to heredity as the children of inadequately-nourished mothers, whose children at birth may be rickety, and in part to induced conditions during school life. As for the first, it has been found by experiment with poultry that the light from a quartz lamp does notably prevent rickets in chickens, and increases ovulation and fertility in eggs of laying hens subjected even for a few minutes daily to ultra-violet rays. So it is seen that the anti-rachitic effects of such rays are most important in developing nerve and muscular tone in children, and so preventing that eye-strain, which only can be imperfectly corrected by spectacles. So convinced are some school-authorities as to the beneficial influence of the ultra-violet rays that, as the progressive school board of Birmingham, England, a quality of window-glass is being introduced to their schoolrooms which does transmit adequate ultra-violet rays. Experimentally, it has been shown that the children of schoolrooms so lighted were relatively three pounds heavier, half an inch taller, and had a notably higher number of red corpuscles per cubic centimetre, than their less fortunate schoolmates.

Fortunate, indeed, is the child of the open spaces, and, perhaps, even the slum-child, who is forced into the street to play for lack of house room, since they find compensation in living in God's sunlight and open air, while the delicately-nurtured child may suffer from overheated rooms and the lack of ultra-violet rays through want of life in the open.

The influence on health of dust-contaminated house-atmospheres and of industrial towns will be dealt with in the next article, while, later, the influence of light upon the growth and health of plants in greenhouses and flower-rooms will be considered.

Tentative Program for First National Fuels Meeting, Fuel Division, A. S. M. E.

An ambitious program, both in its scope and in the selection of speakers will mark the First National Fuels Meeting planned by the American Society of Mechanical Engineers, to be held in St. Louis, October 10-13. John Van Brunt, vice-president of the Combustion Engineering Corporation, is the chairman of the executive committee. John Hunter, well known consulting engineer, is the honorary chairman, and Victor J. Azbe, St. Louis, is the chairman of the general arrangements committee. The program will be divided into four general sections, (a) general, (b) industrial, (c) power plant, (d) smoke abatement. The tentative program is:

(a) GENERAL

"Address on Fuels," Prof. S. W. Parr, professor of applied chemistry, University of Illinois, Urbana, Ill.

"American Fuel Resources," O. P. Hood, chief mechanical engineer, U. S. Bureau of Mines, Washington, D. C.

"Combustion and Heat Transfer," Prof. R. T. Haslam, and H. C. Hottel, Massachusetts Institute of Technology, Cambridge, Mass.

"The Clinkering of Coal Ash," A. C. Fieldner, chief engineer of experiment stations, U. S. Bureau of Mines, Pittsburgh, Pa.

"Factors Governing the Purchase of Fuels," Morgan B. Smith, engineer, General Motors Corp., Detroit, Mich.

"Refractories for High Temperatures," Stewart Phelps, director of Research and Tests, American Refractories Institute Fellowship, Mellon Institute, Pittsburgh, Pa.

"Coal Mining and Coal Preparation from Standpoint of Quality."

"Recent Developments in Low Temperature Coal Carbonization," H. D. Savage, vice-president, Combustion Engineering Corp., New York.

(b) INDUSTRIAL

"Industrial Applications of Heat," Prof. W. Trinks, professor of mechanical engineering, Carnegie Institute of Technology, Pittsburgh, Pa.

"Progress in Gas Producer Practice," W. B. Chapman, president, Chapman Engineering Co., New York.

"The Use of Fuels in Brick Kilns," W. E. Rice, assistant fuel engineer, U. S. Bureau of Mines, Pittsburgh, Pa.

"The Burning of Liquid Fuels," Ernest H. Peabody, president, Peabody Engineering Corp., New York.

"Rotary and Vertical Kilns for Cement, Lime and Gypsum."

"The Relative Values of Gaseous, Liquid and Solid Fuels," F. C. Binnall, assistant manager, Standard Sanitary Mfg. Co., New Brighton, Pa., formerly chemical engineer, General Oil and Gas Corp.

(c) POWER PLANT

"Characteristics of Modern Boilers," E. R. Fish, vice-president, Heine Boiler Co., St. Louis, Mo.

"Characteristics of Modern Stokers," F. H. Daniels, president, Riley Stoker Co., Worcester, Mass.

"Air Preheaters," Frank M. Van Deventer, special engineer, Henry L. Doherty Co., New York.

"Direct-Fired Powdered-Fuel Boilers with Well-Type Furnaces at Charles R. Huntly Station," H. M. Cushing, chief engineer, Buffalo General Electric Co., Buffalo, N. Y.

"Automatic Combustion Control," J. A. Peebles, chief engineer, Hagan Corp., Pittsburgh, Pa.

(d) SMOKE ABATEMENT

"The Measurement of Atmospheric Smoke Pollution, Visible and Invisible," Dr. George T. Moore, director, Missouri Botanical Garden, St. Louis, Mo.

"Smoke Abatement Methods Used In Cleveland," Col. Elliott H. Whitlock, commissioner of smoke inspection, Cleveland, O.

"Managing a Smoke-Abatement Campaign," Erle Ormsby, president, Citizens' Smoke-Abatement League, St. Louis, Mo.

"Furnace Essentials for Smokelessness," H. B. Meller, chief, bureau of smoke regulation, Pittsburgh, Pa.

"Smokeless and Efficient Firing of Domestic Furnaces," Victor J. Azbe, consulting engineer, St. Louis, Mo.

"The Effect of Atmospheric Smoke Pollution—a Summary of Opinions from Current Literature," Prof. A. S. Langsdorf, director of industrial and engineering research, Washington University, St. Louis, Mo.

Officers Nominated for A. S. M. E.

Alexander Dow, president of the Detroit Edison Co., Detroit, Mich., is the choice of the A. S. M. E. Nominating Committee for president of the American Society of Mechanical Engineers for 1928. Other nominees are:

For vice-presidents: John H. Lawrence, engineering manager and director of Thomas E. Murray, Inc.; E. A. Muller, chief engineer and general manager of the King Machine Tool Company; Newell Sanders, president of the Newell Sanders Plow Company; Paul Wright, of Paul Wright & Company, designer and patentee of the Wright vertical pipe water-tube boiler.

For managers: L. B. McMillan, chief engineer of Johns-Manville Corp., New York; William A. Hanley, of Eli Lilly & Co., Indianapolis, Ind., manufacturing chemists; F. H. Dorner, mechanical engineer, Milwaukee, Wis.

National Association of Plumbing and Heating Salesmen Elect Officers

With practically every chapter represented by the one hundred members assembled at the Robert Treat Hotel, Newark, N. J., the National Association of Plumbing and Heating Salesmen held its annual convention, May 26-28. William Weber, of New York, was unanimously elected president for the ensuing year. The other officers chosen were: Norman Farlow, of San Francisco, vice-president; R. J. Maggi, Pittsburgh, second vice-president; William Krueger, Newark, secretary; and C. W. Cope, treasurer. For governors: Porter West, Detroit, and Frank Murphy, Cleveland.

Design of Lumber Dry Kilns

Part III

ONE of the most elaborate types of dry kilns is that designed by the National Dry Kiln Company, of Indianapolis, Ind. This kiln combines drying with moistening in alternating periods. Paradoxical as it may seem, the claim is made that better and quicker drying is secured by this method than when ordinary straight drying is used. The moistening is effected by increasing the humidity from time to time and then going on with the drying process the same as usual.

Lumber is placed in a dry kiln for three distinct reasons, the primary one being, of course, to dry the wood and drive out the moisture; the secondary one is to effect shrinkage in a normal and uniform manner; and the third is to leave the stock straight, clean and strong, so that it is fit for the purpose for which it is intended. Each of these objects is closely related to the other and all must be accomplished in order to secure the most successful results.

The importance of the second item mentioned above is not always so well understood as the other two. One of the foremost authorities says that if lumber must shrink, the faster it is dried, the smaller will be the shrinkage. If lumber does not shrink normally and uniformly, it is full of stresses and strains; when later cut or surfaced, these make themselves evident and will always contain defects of this character. Such lumber is known in the trade as "case-hardened."

Case-hardening may be liberally defined as the excessive drying of the outer surface while the core is still wet, causing the pores in the outer fibres to close and thus interfering with the escape of moisture from the material. Under this condition drying cannot be hastened to any extent without causing checking, warping or other damaging effects.

HEAT SUPPLIED BY PIPE COILS

In the National Dry Kiln Company's kilns, a typical one of which is here illustrated, the heating is effected by a system of vertical or horizontal pipe coils placed immediately beneath the lumber trucks. The moistening is provided for by a system of perforated steam pipes placed just above the heating pipes, along the side walls or, sometimes, at the top of the kiln.

In these kilns no fans are used and the circulation obtained is a purely gravity one. Fresh-air doors are placed in the ends of the kiln below the heating pipes and these doors connect with ducts which distribute the air throughout the kiln. The entering air, after being heated, and also humidified to the desired percentage, passes up through the courses of lumber, becomes saturated or nearly so, and drops to the level of the flue on the side walls whence it is exhausted out through the chimneys.

DESIGN PROVIDES FOR "DRYING FROM THE INSIDE"

The kilns are designed on the basic principle that moisture moves away from heat and not towards it. Thus, when straight and unrelieved heat is applied to wet or green lumber, this company maintains that the moisture is driven toward the center of each piece and concentrates in a location where it is particularly hard to remove. Therefore, the kiln has been arranged to "dry from the inside" by driving the moisture from the center of each piece toward the outside where it can be evaporated more readily. This is accomplished via the "Moistat" system.

If we accept the principle that moisture always travels away from heat and in the direction of cooler temperature, then it is not difficult to understand that, if at certain times in the drying process, the temperature of the surface of the lumber in process of drying is suddenly reduced to a point considerably lower than that of the interior, then the moisture in the interior will tend to flow toward the cooler surface.

The Moistat system consists of a series of steam immersions followed by a corresponding number of drying periods, both of which are automatically controlled. The effect of the steam immersions is to heat the whole lot of material above the normal temperature of the kiln, this superheating being accomplished by the latent heat in the steam used for humidifying and the rapid absorption of this heat by the lumber.

During the periods of steam immersion, the lumber takes on a certain amount of moisture which is deposited on the surface fibres, and does not penetrate the material to any extent.

The deposit of moisture on the surface, far from being detrimental, on the contrary, is of considerable advantage in two ways: First, it keeps the surface of the lumber soft, and, second, the re-evaporation of this moisture during the subsequent drying period takes up latent heat and assists in lowering the temperature of the outer surface so that the interior moisture will flow toward the surface.

By the above-described means a substantial difference in temperature is set up between the inside of the lumber and the outside, with the inside temperature higher. Drying cycles are continued only so long as the lumber continues to give up moisture freely; just as soon as there is a lag in the evaporation from the lumber, another steam bath is staged, and another drying period is put into operation.

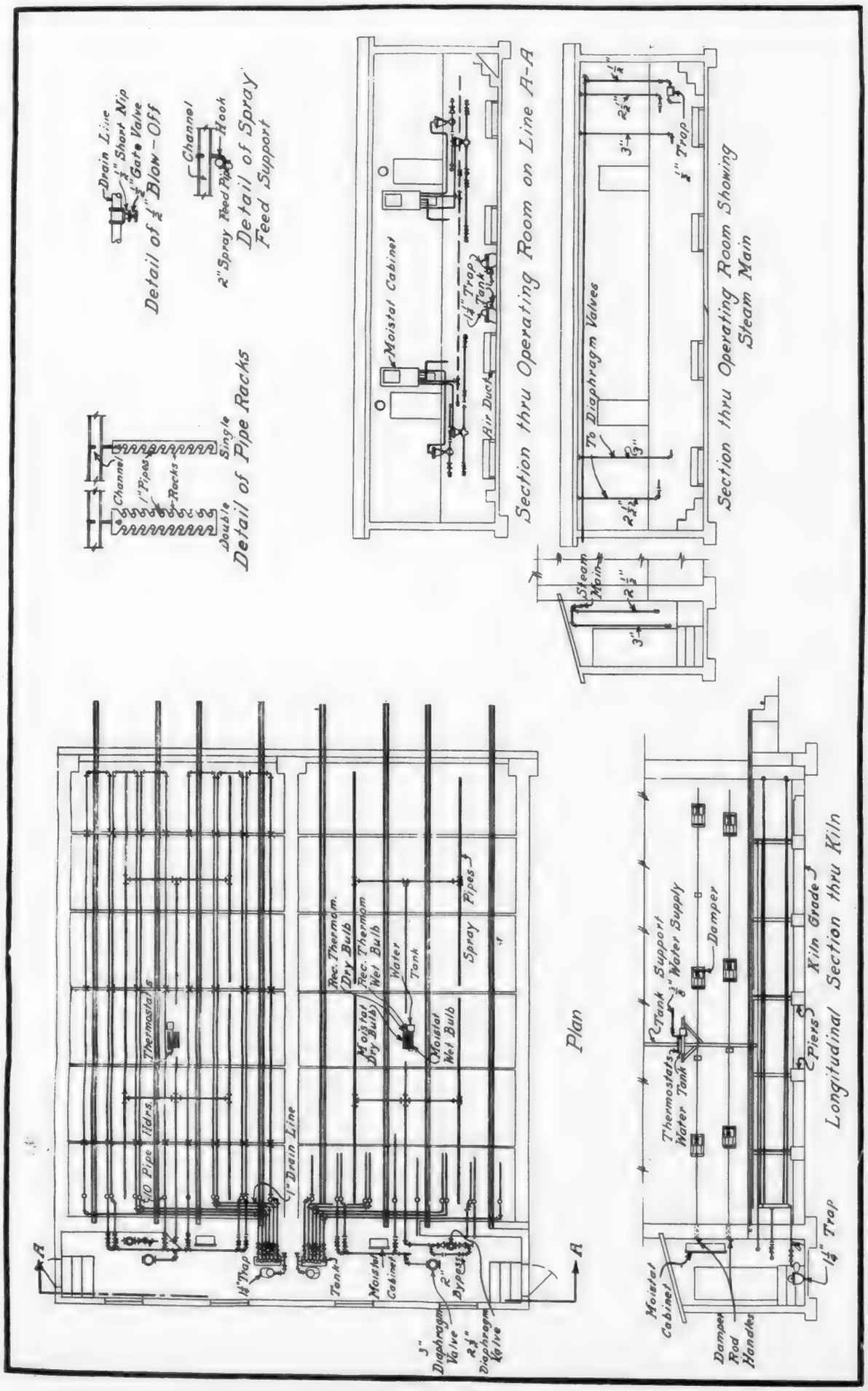
Data Developed on Variance of Roof and Ground Temperatures

To settle the question of whether the official temperature reports given out by the U. S. Weather Bureau actually are the conditions under which the average man exists, a series of observations of daily temperatures covering a period of two years was taken at Topeka, Kan. Interesting data were obtained showing the variation between temperatures taken at the street level, and those recorded at the top of a 100-ft. office building.

B. R. Laskowski, of the U. S. Weather Bureau, Topeka, writing for the house organ of the Taylor Instrument Co., Rochester, N. Y., presents tables indicating the difference, month by month during the year, between these two temperatures. From these tables it is seen that the official temperature reports in large cities, which are generally made from reading on roofs of high buildings, do not tally with the actual temperature at the ground level where the majority of people live.

Through a period from October, 1924, to October, 1926, these tabulations show that the lowest minimum temperature on the street sometimes differs from the lowest minimum temperature taken on the roof by as much as 5° to 6° F. This variation probably is due to the more rapid cooling-off process that occurs on the ground as compared to that at moderate heights. It will be particularly noticeable on a hot, midsummer night when the humidity is high, or on a still, cold night when the ground is frozen. An interesting point brought out here is that the sharp winter winds act as an agent for regulating this difference in temperature, since the ground and higher air are continually blown together, and practically blended into the same temperature.

In order to have reports correspond more closely with actual ground-level temperatures the Weather Bureau is changing the position of thermometers in large cities like New York and Chicago, by placing them on the outskirts where they can be set near the ground.



A Lumber Dry Kiln System Which Provides for Drying "From the Inside"

American Society of Heating and Ventilating Engineers

Society Co-Operating in Revision of Refrigeration Safety Code

At the request of the American Engineering Standards Committee, the Council, at a recent meeting, appointed J. I. Lyle and Lee Nusbaum to be members of a committee on the revision of the Refrigeration Safety Code, of which F. E. Matthews is chairman.

Cleveland Chapter Elects Officers

At the May meeting of the Cleveland Chapter, held May 13, President J. J. Kissick reported that Senate bill No. 255, to change the State Building Code, will rest until the General Assembly next meets. The president was authorized to appoint a committee to study the new proposed State Piping Code.

The following officers were unanimously elected for 1927-28: President, J. J. Kissick; vice-president, W. Charles M. Clarke; secretary, W. C. Kammerer, treasurer, P. R. Adrianse. Board of governors: R. S. Mayer, E. H. Heinle and T. A. Weager.

Brief papers on air filtration were presented by W. G. Franch and J. L. Harphan.

Minnesota Chapter Elects Officers

Following a golf tournament at the Minneapolis Country Club, the local chapter elected the following officers for the ensuing year: Albert Buenger, president; D. C. Ruff, vice-president, and A. J. Hutch, secretary-treasurer, these with R. W. Otto and D. M. Forfar to constitute the board of governors.

New Kansas City Building Code Adopts Societies' Standards

In a building code recently passed by the Kansas City Building Council, the following clauses appear:

SECTION 30-11. WARM-AIR FURNACES

1. When a warm-air furnace is installed for heating to comply with the requirement of Section 30-6 (70°) it shall be capable of heating the occupied space with a temperature of not exceeding 175° at the registers. No furnace air supply shall be taken directly from a cellar. When a gravity warm-air furnace is installed to comply with the requirements of Section 30-6 (70° in zero weather) the capacity of the furnace, the warm-air pipes, stacks, registers, and return ducts shall conform to the formulae of the third edition (June 1, 1924) of the Standard Code of the National Warm-Air Heating & Ventilating Association in connection with the addition thereto of December 2, 1926.

SECTION 30-13. VENTILATING

1. All rooms or buildings in which the public congregates shall be provided

Group of Delegates to the Semi-Annual Meeting of the American Society of Heating and Ventilating Engineers, at The Greenbrier, White Sulphur Springs, W. Va., June 27-30, 1927

with a ventilating system that shall effectively protect the health and comfort of the public and employees.

2. Such ventilating systems shall be designed, installed and operated so that the results as indicated by tests shall conform to standards as established by the American Society of Heating and Ventilating Engineers' Guide, 1925-1926 Edition, Part Two, Chapters XV and XVI.

Organization of Canadian Plumbing and Heating Guild

A reorganization of the Ontario Society of Domestic Sanitary and Heating Engineers was effected at an important meeting, held in Hamilton, June 11, when the society had a re-birth under the name of the Canadian Plumbing and Heating Guild. A business administrator was appointed, this office going to Louis M. Singer. The officers are: President, Roy E. Belyea; vice-president, George R. Baker; secretary-treasurer, Harry Weinraub, all of Toronto. The new organization begins its activities with a membership of 250.

In his address at the meeting, President Roy H. Belyea gave some indication of the causes which led to the reorganization of the society in the statement that:

"At the sixteenth annual convention of the Ontario Society, Domestic Sanitary and Heating Engineers, held on March 25, 1927, at the city of Guelph, you will recall the condition of affairs that existed throughout the plumbing and heating industry in Ontario. The situation appeared hopeless and it was very evident that some drastic changes would have to be made at once in the method of dealing with trade problems and of governing the affairs of the industry.

"Your humble servant, although not blind to the almost unsurmountable obstacles which presented themselves, cheerfully accepted the responsibility of endeavoring to reorganize the society, realizing that he had in the vice-president, George Baker, an earnest and sympathetic colleague and in the secretary-treasurer, Harry Weinraub, an assistant who deservedly held the confidence and respect of all who knew him.

"Acting under your instructions, we proceeded on the lines explained to and accepted by the Guelph convention, in the hope that we might succeed in defining the proper channels of trade and securing for all those connected with the industry a fair remuneration for services rendered, and for the general public a square deal.

"Without fear or misgiving, facing possible defeat and certain discouragement and the spectre of the alleged selfish antagonisms of entrenched interests, we applied ourselves to the task in hand with all the energy and aggressiveness we possessed, giving of our time and effort in unstinted measure to accomplish that which they believed to be, beyond peradventure of a doubt, the one and only promising solution of our trade evils in a fair, honorable and permanent form."

Minneapolis Heat Regulator Company Holds Convention

An extensive series of sales conferences and meetings was held June 13-24, at the home office of the Minneapolis Heat Regulator Co., Minneapolis, coincident with the convention of the National Association of Master Plumbers. One of the important features in the sales conference was a discussion of the development of the company's program, outlining for its dealers a new and well defined plan to assist them in building volume sales, and in overcoming slack seasons in the heating and plumbing business. This discussion was led by Chester D. Lyford, assistant sales manager.

The three days of conferences by road salesmen were presided over by C. B. Sweatt, sales manager and treasurer of the company. Conferences of branch office managers and distributors also occupied three days, during which the company's advertising and sales plan was thoroughly explained and discussed.

Branch managers who attended the conferences included Walter H. Wilson, vice-president, New York; Arnold Michelson, Philadelphia; George Kingsland, Boston; E. B. Evleth, St. Louis; Warren Jennings, Chicago; William Arnoldy, Milwaukee; E. H. Wesnage, Minneapolis; H. C. Jenkins, Minneapolis, and Ralph Senderling, Cleveland.

Attending the same convention of branch managers was a group of distributors which was started on the new system of coverage selling. These distributors were C. O. Baring, Minneapolis Heat Regulator Sales, Inc., Hartford, Conn.; Kenneth Sprague, of Frank Sprague, Syracuse, N. Y.; F. J. McTernan, Buffalo; Walter Fleming, Detroit; W. R. Judd and W. W. Judd, Cincinnati; Arthur Erickson, of Arthur F. Erickson Co., Portland, Seattle, and Los Angeles.

George Enzinger, of the Olson & Enzinger Advertising Agency, Milwaukee, addressed the various meetings, giving the members of the organization a detailed explanation of the company's advertising plans for the next twelve months, and pointing out methods by which they can cash in on this method. All visiting members of the organization were shown through the company's new plant which was opened for occupancy on June 6. The tower of the new building was flood-lighted during the entire period, attracting considerable attention.

May Oil-Burner Dealers in Annual Convention

May oil-burner dealers gathered at the new Southern Hotel, in Baltimore, June 27-28, for a convention that marked another milestone in the growth of this active organization. A feature of the meeting was the announcement of a new model Quiet May, capable of heating approximately 600 sq. ft. of steam radiation, and selling for $375.

The two days of the convention were occupied with interesting and informative addresses and discussions of retail financing, advertising, selling, sales engineering, and dealer business organization. The convention program was featured by addresses from Homer R. Linn, American Radiator Company; Charles Wadsworth, Barton, Durstine and Osborn; R. W. Burman, Commercial Credit Company; Rufus Rickhart, Oil Heating Institute; A. P. Mudgett, Honeywell Heating Specialties Company; E. M. Fleischmann, president, and A. J. Fleischmann, treasurer, May Oil Burner Corporation.

On Monday, June 27, the delegates were divided into groups, and shown the workings of the laboratory, and testing and assembling of the Quiet May burner. Then followed an interesting program, and the presentation of prizes to the winners of the pre-convention sales contest. Long Island Engineering Corp., Elmhurst, L. I., N. Y., sold the greatest number of burners during the contest, and was presented with a handsome silver loving-cup. Fred Heuberger, retail salesman for H. Lieblich and Co., New York, was awarded a gold watch for selling the largest number of burners.

New Edition of Standard Furnace Code

Important changes mark the fourth edition of the Standard Furnace Code, which is now ready for distribution by the National Warm-Air Heating and Ventilating Association. The previous edition has been in force since 1924, and the many advances in the technique of warm-air heating, together with refinement in empirical formulae, have necessitated the revision.

Elaboration of the method for determining sizes of warm-air pipes, wall stacks and furnaces constitutes the principal change. Instead of working with a single factor, assuming the conventional cheap frame construction, the code now provides a table giving factors for many kinds of brick, tile and stucco walls.

The new furnace rating formula is also presented, with the working-out of a concrete example.

Copies of the code are available through the secretary of the association, Allan W. Williams, Columbus, O.

Business of Contracting

Part III

A GREAT deal may be accomplished to facilitate the computing of costs—and, therefore, profits—by handling the jobs properly when they first come into the office. In regard to this, almost every shop is faced with at least two—and sometimes three—kinds of work. First, is the large contract which may take weeks or months to carry out; second, is the small job which may require only a few days or a week to complete; and, third, is the sale of miscellaneous material made from time to time, often merely as a convenience to a customer, or prospective customer.

When a shop makes a specialty of small jobbing and does not attempt to enter into major contracting work, the first class of work need not be considered, and, with very large contractors, the amount of material sold "over the counter" sometimes may be eliminated. The average shop, however, is likely to have all three kinds of work to deal with and, for this reason, the entire three classes of business will be considered.

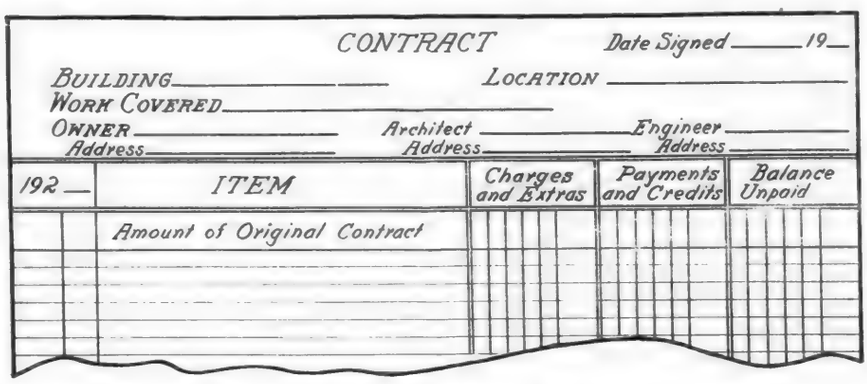
For large contracts a book entitled "Record of Contracts" should be carried; this book has entered in it a full and complete record of all contracts, each contract being listed as soon as signed, and being given a number in the order in which the contracts are taken. That is to say, the first contract signed would be No. 1, and the second contract signed would be No. 2, and so on, for all contracts.

Now, what determines a contract as distinguished from jobbing? Actually there is nothing to differentiate between a contract and a job for which a fixed price has been set before undertaking. One is a contract just as much as the other. For this reason some firms run their jobbing work and their contracts on the same records and feel that their clerical work is simplified by such procedure. Other firms maintain that there is a radical difference in the classes of work involved in taking on a contract for a $50,000 brand new installation and in telling John Jones that you will repair his cracked boiler section for $200.

It is quite true that one of these will have a formal contract, with various stipulations to be met, and probably an architect and possibly an engineer to be pleased, while the other will often involve no written contract at all or, at most, merely a "memo" as to what the price will be for the work itemized. Payments, too, are likely to be on an entirely different basis and the time during which the work is being carried on will vary greatly.

For a shop doing a considerable amount of both classes of work, a dual system is advisable, but for a shop doing practically all jobbing, with now and then an occasional contract, or for a shop doing a great deal of contracting, with only an infrequent repair job, a single system is better.

In Fig. 5 is shown a typical contract sheet which may be used for recording contracts—or contracts and jobbing. This sheet is self-explanatory, as far as headings are concerned. The way it is used is to post the amount of the original contract opposite the printed description on the first line, this amount being placed in the column "Balance Unpaid," and indicating that as soon as the contract is signed there is an asset on the company's books of the amount of the contract. This asset is balanced up by a liability on the company's part to supply the necessary labor and material to carry out the contract.


CONTRACT Date Signed ____ 19__

BUILDING ____ LOCATION ____

WORK COVERED ____

OWNER ____ Architect ____ Engineer ____

Address ____ Address ____ Address ____

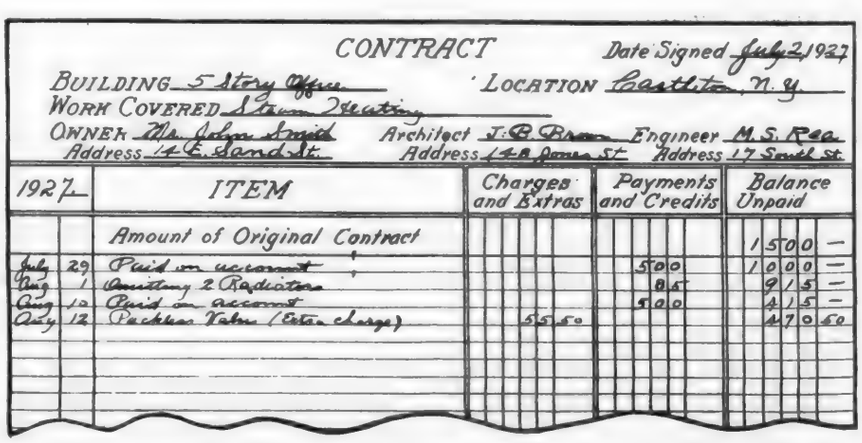
192 __	ITEM	Charges and Extras	Payments and Credits	Balance Unpaid
	Amount of Original Contract			

Fig. 5. This Form May Be Used For Recording Contracts

Under the first posting of the amount of the original contract will appear, from time to time, the amounts of payments made against the total amount of the contract, these payments being posted, as far as the amounts are concerned, in the column marked "Credits" and deducted from the amount shown in the "Balance Unpaid" column, on the line immediately above, and a new balance placed in the "Balance Unpaid" column. This new balance will indicate, in each case, how much remains unpaid on the contract at any particular time without adding up a lot of figures. It is the same scheme followed in many savings banks of carrying out a balance after each deposit or withdrawal so that the amount remaining on the account immediately is ascertainable.

All alterations, from the original work as contracted for, are also posted in order according to date and the amounts placed in the column marked "Charges and Extras," if the cost is increased, or in the column marked "Payments and Credits," if the owner is entitled to a reduction for the change involved. A balance also is placed opposite these headings so that the contract condition—as far as payments are affected—is always visible at a single glance.

In Fig. 6 a partially-filled out sheet is shown to illustrate how simply and plainly this system works. Here is indicated a contract for the installation of a steam heating system for John Smith, for which the contract price was $1500, and a payment of $500 was made on account after the work was partially completed. Then follows a change in-


CONTRACT Date Signed July 2/1927

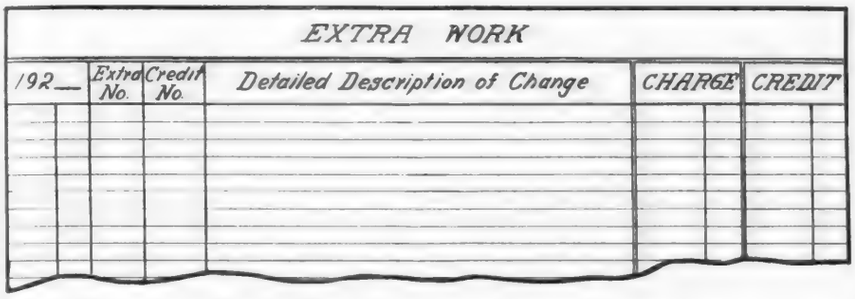
BUILDING 5 Story Office LOCATION Castleton, N. Y.

WORK COVERED Steam Heating

OWNER Mr. John Smith Address 14 E. Sand St. Architect J. B. Brown Address 148 James St. Engineer M. S. Rae Address 17 Smith St.

1927		ITEM	Charges and Extras	Payments and Credits	Balance Unpaid
		Amount of Original Contract			1500 —
July	29	Paid on account		500	1000 —
Aug	1	Omitting 2 Radiators		85	915 —
Aug	10	Paid on account		500	415 —
July	12	Packless Valves (Extra charge)	55 50		470 50

Fig. 6. Simplicity Characterizes the Use of This Contract Form


EXTRA WORK

192__	Extra No.	Credit No.	Detailed Description of Change	CHARGE		CREDIT	

Fig. 7. This Form May Be Printed on Reverse Side of Contract Form (Fig. 6) and Used to Record Authorized Changes

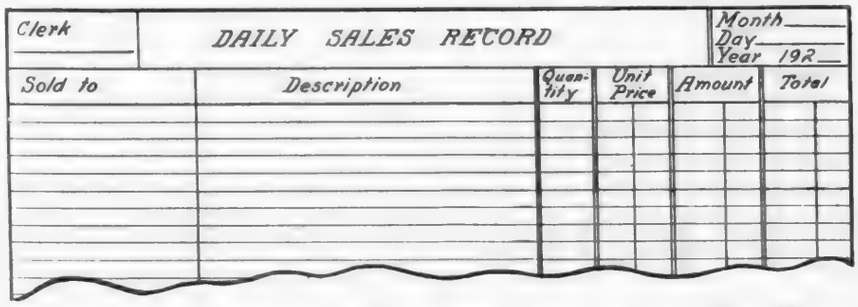
volving the omission of two radiators which entitled the owner to a credit of $95 and which is shown just the same as a payment on account. Then another payment of $500 is recorded and an extra charge for the substitution of packless valves on the radiators, amounting to $55.50. After adding this to the balance unpaid on the contract, the state of the account is obtainable at once by glancing at the "Balance Unpaid" remaining. Of course, further payments, credits or extras would be added as they occur until the entire "Balance Unpaid" is wiped out.

Sometimes all the credits are numbered in one series and the extra charges in another; in this case the first credit would be designated as "Credit No. 1" and the first extra as "Extra No. 1." If both credits and extras are numbered in one series, the first credit would be designated as "Extra No. 1—Credit" and the second extra would then be "Extra No. 2—Charge," etc.

It is most advisable to give full details of all changes in the original contract to avoid disputes later, and for this purpose the reverse side of the sheet may be used. Here should be noted the date the change is authorized, of just what the change consisted, and the amount charged or credited for same. If the sheet is ruled, somewhat according to the scheme shown in Fig. 7, it will be found to suit the purpose quite well.

Where a separate system is run for small jobbing the sheets may follow the same scheme, except that the title should be changed to "Job," instead of "Contract," and another color of paper to distinguish more readily between the two classes of work is a good idea.

Odds and ends sold "over the counter" always should be kept in a separate book or file. There is a marked difference between the class of income received from such sources and that from contracts or jobbing work. This is because of the fact that there is no element of labor involved and little, if any, hazard or contingency concerned. The price of the article so sold is determined from the cost, and the cost is known before sale with absolute exactness—that is, if a proper cost system is being operated. For this reason the labor contingency does not enter into the transaction and the future purchase of material to satisfy a contract obligation does not exist. Moreover, such sales generally are of small amounts, but in considerable frequency, so that to treat them as contracts or jobbing not only is incorrect but also involves the use of a considerable amount of unnecessary stationery as well.


Clerk _____ DAILY SALES RECORD Month____ Day____ Year 192__

Sold to	Description	Quantity	Unit Price	Amount		Total	

Fig. 8. Entering Every Sale on This Record Stops Little Leaks That Might Ruin a Business

Such sales are best handled by means of a sales record, or day book, in which a sheet is allowed for each day and all the sales for that day are posted thereon. In Fig. 8 is given a typical ruling for a daily sales record, covering small miscellaneous items sold without labor of any kind entering the transaction. In the first column is placed the purchaser's name, unless it is a cash transaction which is paid in full at the time of purchase. In this case the word "cash" is simply written in, instead of the name of the purchaser.

In the second column is placed a description of the goods sold, with the size or other designating notation, and in the next column is recorded the quantity and the unit price of the article; multiplication of the quantity and the unit price will produce the amount of the purchase which is placed in the next column marked "Amount." With a single purchase the "Amount" would be carried over in the last column marked "TOTAL," while, if several articles were purchased, the amounts for the individual articles would be added up and the sum placed in the "TOTAL" column.

The next article will take up the application of the forms illustrated so as to secure intelligent information from them in a way to be of value.

T. E. B.'s Model Heating and Plumbing Store

More than 5,000 members, delegates and visitors attending the annual convention of the National Association of Master Plumbers in Minneapolis, June 21 to 25, visited the T.E.B. model heating and plumbing store at the Minneapolis Auditorium. As a result of the exhibit, heating contractors and master plumbers came away from the convention with the very latest ideas in store and salesroom planning. The exhibit was 75 ft. long and 25 ft. wide and was the most complete of its kind ever arranged.

The two display windows were actual size and were trimmed and redecorated every day of the convention. Window trimmers demonstrated how show windows easily can be prepared at low cost.

Seats were provided in front of the windows for the use of the members and visitors. That the exhibit will be productive of results was evidenced by the fact that over 1,000 visitors signed cards in order to receive a booklet of diagrams and sketches showing the layout of the model store and the arrangement of the equipment.

Lighting fixtures and display material were used to show how attractive and appealing a display window can be made with very little expense.

This store embodied the results of seven years' experience in store planning and window display, and only up-to-date ideas in salesroom arrangement were shown.

The exhibit included only equipment suitable for the retail branches of the heating and plumbing industries. The private office included two desks, one for general use and one for estimating use, with chairs, a metal case for stationery and other office supplies, and a clothes cabinet. The general office included two desks, one for bookkeeping use and one typewriter desk, with chairs, a metal safe cabinet, a cash register, billing machine and other general office equipment.

In the shop in the rear of the store were the latest designs of storage bins, pipe racks, work benches and other shop equipment. A toilet room for workmen was provided with lockers for the workmen's clothes.

A booklet has been prepared illustrating and describing the model store. A copy may be had by addressing the Trade Extension Bureau at Evansville, Ind.

Simplifying Forced Hot Water Systems with Equiflo Valves

The trend towards standardization and simplicity in heating work is exemplified in the development of the Equiflo valve, manufactured by the Grinnell Co., Providence, R. I., to save labor and expense in the design and installation of forced-circulation water heating systems. Such items as the changes found necessary during construction, the varying resistances due to changes in water temperature, and much of the figuring involved in the original calculations, may be reduced materially, it is stated, where Equiflo valves are installed.

The basic principle upon which the valve is designed is the separate flow-controlling sleeve which is inserted in the valve after the piping system is completed and even the valve body itself installed. The required resistance for the sleeves or tubes is proportioned by the manufacturers from calculations made from plans showing, not the way it was intended to install the work, but how the work actually was put in. For this purpose the contractor forwards a set of corrected prints to the manufacturer as soon as the piping is completed and the valve bodies are in place; from this plan the proper size sleeves are calculated and the plan is returned to the contractor with every radiator numbered. A shipment of sleeves follows, every one of which is numbered to correspond with the particular radiator designation cal'ed for on the plan.

The contractor then removes the bonnets of the various radiator valves, drops in the sleeve with the corresponding number, screws back the bonnet and the whole system is ready for operation.

Having arranged matters for the contractor's benefit, the manufacturers have not forgotten the designer of forced hot water systems; on the contrary, they have gone to the extent of preparing tables resembling those used for steam pipe sizing and the work of laying out a forced hot water system may now compare favorably with that of a steam system. These tables are arranged for 20° and 30° F. drop in the radiators and for runs ranging from 200 ft. to 3000 ft.

The additional cost of these special valves over ordinary radiator valves, it is stated, is usually more than offset by the economy of the piping arrangement.

Like most pipe-sizing tables, these tables are for straight pipe and a suitable allowance for fittings must be made. The manufacturers suggest that the total length of run be measured off of the plans and the average size of pipe be estimated or assumed. Then count the number of elbows, offsets, tees, etc., in the length of the circuit and multiply the number of such turns by *twice* the diameter of the assumed average size of pipe. For instance, with a system in which the midway size of pipe was, say, 3 in., with 50 elbows, the amount to be added to the length of run shown by the straight pipe would be 50x3x2 or 300 ft.

With the total length of run, plus the allowance for fittings, it is only necessary to take from the table the size of pipe required for the amount of radiation being handled and the temperature drop through the radiator allowable.

Pump heads are likewise included in the pipe-sizing tab'es so that the theoretical head on the pump is at once obtained direct from the table. The manufacturers recommend that about 25% be added to the head so obtained in order to get a correct pump rating.

In connecting up the mains for each building it is stated that the mains should be arranged in reverse connection, so that the nearest radiator on the supply is the farthest radiator on the return and vice versa. Where two boilers are installed the supply and return connections also are reversed to avoid short-circuiting the near boiler.

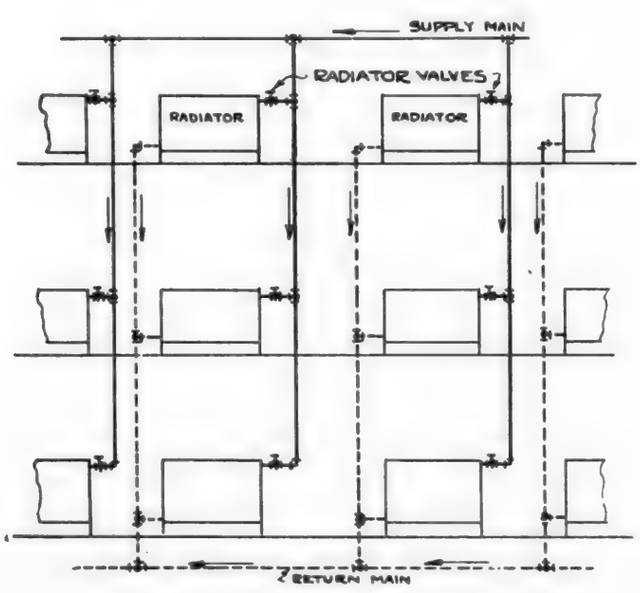
Combined with the pipe-sizing tables are other schedules showing the proper size of expansion tanks, the connections for same, as well as pump ratings and typical piping diagrams for both pumps and boilers. Every indication would point to the design of forced hot water systems now requiring no more calculation than ordinary steam systems, and the manufacturer guarantees a balanced circulation where the suggestions above outlined are carried out.

STANDARDS OF THE HYDRAULIC SOCIETY has been issued in a fourth edition, comprising 80 pages, 8½ in. x 11 in. in size, which compares with a 19-page booklet, 6 in. x 9 in., published in 1921 as the first edition.

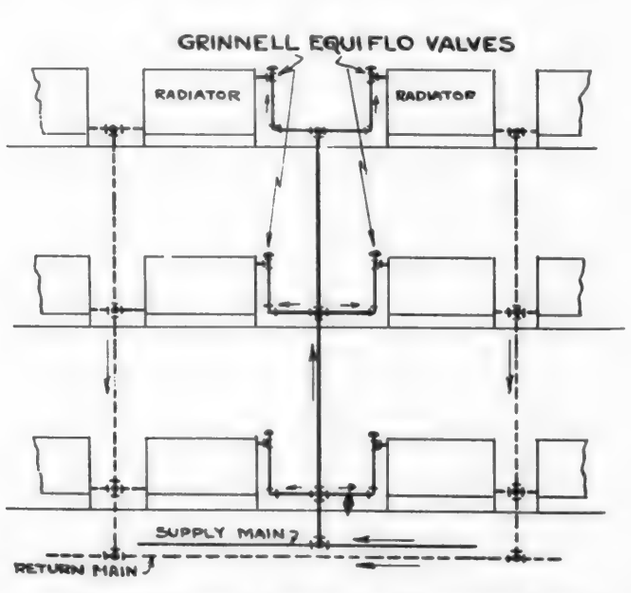
The new edition is profusely illustrated with charts, tables, drawings and halftones of pumps and pump parts.

It contains sections on definitions and values; extracts from pump test codes; a revised pump classification; description of types, parts and definitions pertaining to the several classes of pumps (reciprocating displacement, rotary displacement, centrifugal and deep well); instructions for installing and operating each type; a recommended contract form for use in the pump industry; data, tables, curves and formula, including pipe friction data for both water and oil, and a comprehensive list of materials recommended for pumping different liquids.

Published at the society's headquarters, 90 West St., New York, C. H. Rohrbach, secretary. Price 50 cents.



Usual Design of Riser Piping to Balance Circulation in Forced Circulation Water Heating Systems



Piping Arrangement Possible When Grinnell Equiflo Valves Are Used, with Three Risers in Place of Six

Correspondence

Conducted by T. W. Reynolds

Sizing Vacuum Heating Systems

EDITOR HEATING AND VENTILATING MAGAZINE:

I am a subscriber to your magazine and would like to have you send me some accurate data for sizing of supply mains, main supply riser, supply and return risers and return mains for overhead or down-feed systems with a vacuum pump.

I know that the sizes should be approximately the same as for an up-feed system, but I believe that we could use smaller sizes on a down-feed system.

LAWRENCE M. TARRY.

Kansas City, Mo.

Most approved methods of sizing pipes for steam heating of any kind are based on drop in pressure and not on the maximum amount of radiation that a pipe of given size will carry, regardless of everything else. In other words, every heating system operated by steam has certain limitations which must be conformed to in order to produce a properly-functioning apparatus, and these limitations are different in almost every job, as well as in almost every type of system.

For instance, in a vacuum system (in which our correspondent seems particularly interested) if the length of run from the boiler to the farthest radiator is 100 ft., then a certain size of pipe would be used; while, if the length of run were 200 ft., then a larger size of pipe might be necessary. This follows out all through the sizing of steam piping and, as a general rule, it may be said that as the length of run is extended the size of the pipe will increase.

The reason for this is that economical design demands that the maximum allowable drop be utilized in order to keep the pipe sizes down as small as possible. And when we say, as small as possible, we mean as small as satisfactory operation will permit. The drop in pressure is caused by the friction resulting from the steam rubbing against the surface of the pipe as it passes along, and for this reason, the longer the pipe, the greater the drop, all other conditions being equal.

In the Standard Data Sheets published by THE HEATING AND VENTILATING MAGAZINE, Nos. 128-A, 128-B, 128-C and 128-D, are given tables for various drops for various lengths of run and it must be remembered that these drops are for straight pipe and do not include friction caused by fittings, valves, etc.; therefore, if a table is used for, say, ½ lb. drop, the actual drop will be ½ lb. for the straight pipe, plus whatever the additional may be that is caused by the fittings. Experience has shown that for ordinary work the fittings will about double the drop obtained in the straight pipe.

So when the ½ lb. table is used, the actual drop will be in the neighborhood of 1 lb. Conversely, if a ½ lb. drop is the total drop permissible, then the ¼ lb. table should be used, as the ¼ lb. drop in the pipe, plus another ¼ lb. for the fittings, will equal the ½ lb. allowable.

Now in figuring the length of run, all the run from the boiler to the farthest radiator is considered. That is to say, the riser is included in this total length. When using a table based on the total run, all pipes must be sized from this table in order to have each section of the line produce its fair proportion of drop and no more. To put it more concretely, if a 400 ft. table is being used, all pipes must be sized from this table so that each 100 ft. of run will produce a quarter of the entire drop, while if a 1000 ft. run table is being used, all pipes must be sized from this 1000 ft. basis so that each 100 ft. will produce 1/10 of the entire drop. The minute some other size not in accordance with the table is introduced, the drop will change and the whole system may suffer.

From the above it will be seen that a riser cannot consistently be sized any differently from the main if the proportion of drop that should occur in the riser is to be maintained. If the riser is made larger, then it is oversized because the size given in the table would satisfactorily serve, while if the riser is made smaller than the table size then the drop in the riser will be excessive and the farthest radiator may fail to receive its proper supply of steam.

The only time when this rule may be modified is in cases of long and short runs where the long run is sized, as explained above, and the short run is sized to produce the same drop between the last radiator on the short run and the boiler as between the last radiator on the long run and the boiler. For example: Assume a boiler with two main branches, each branch carrying the same amount of radiation but one branch showing a run of 400 ft. from the farthest radiator to the boiler and the other branch showing a run of only 200 ft. for the same condition. If we assume that a total drop of 1 lb. is permissible for this particular case, then the ½ lb. table for straight pipe would be used and the long run would be sized on the basis of 400 ft. run, while the short run would use the same table but with radiation and pipe sizes based on 200 ft. run.

Provided the risers are sized by the same schedule as the main to which they are connected, then the drop between the boiler and the farthest radiators on both the long run and the short run will be the same, or 1 lb.

There is no doubt that a down-feed riser will carry satisfactorily more radiation than an up-feed one and tables give an increase of 20% to 65% in allowable capacity when down-feed is used over the normal up-feed rating. The greatest increase in capacity occurs on the smaller pipe sizes and a lesser increase is shown for sizes around 2 in. while for 3½ in. and 4 in., the smallest difference is indicated.

One matter that should not be forgotten in sizing risers for a down-feed system is to increase the riser one pipe size near the bottom for risers of moderate height and two pipe sizes for risers of eight stories or over so as to take care of the drip coming down the riser which increases as the bottom of the riser is approached.

"The Next Size Larger"

EDITOR HEATING AND VENTILATING MAGAZINE:

It is a very important question that is asked by C. E. in the April issue, "What is the use of calculating exact pipe diameters when afterwards we cannot get pipes of the right diameters?" Your answer, it seems to me, does not give full value to the earnestness of the question. The same question was asked years ago in Europe and the correct answer is now provided.

Given the commercial pipe sizes, it is possible to calculate an installation with absolute correctness. A hot water system, with radiators as far away as 90 to 100 meters, beginning to circulate at 28° or 30° C. is not an exception. Circulation begins in each radiator, the one nearest the boiler and the most distant ones, at the same time.

It is a mistake to say, "Take the nearest larger diameter." Making the diameter too large in one circuit involves *ipso facto* that of another circuit which will be too small.

Each circuit, namely: Boiler-pipeline-radiator-pipeline-boiler, has its own pressure-head that is used in full. Only, when the calculated pressure-head is equal to the actual pressure-drop, the radiators will give the right amount of heat. And only when this is the case for all the circuits will the installation give accurately what is asked of it. When one of the circuits gets more water or steam than is meant for it, another one, or several others, will get too little.

J. BLANSJAAN.

Enschedé, Holland.

American Oil Burner Association

Next Convention to Be Held in Chicago

The directors of the American Oil Burner Association met at the Hotel Statler in Detroit, July 12-13. Chicago was selected as the convention city for 1928, and the Stevens Hotel chosen for the meetings and oil-burner exposition, April 3-5.

A large part of the second day of the meeting was devoted to a discussion of the legal report of the patent situation.

Live Issues Facing the Oil-Burner Industry

Settlement of patent litigation within the industry itself; the proposed co-ordination of state laws and regulations affecting oil heating for domestic and industrial purposes; similar standards of installation methods in all communities, and the advertising of oil-heating devices and equipment in the newspapers of cities and communities on a national scale, were the major subjects discussed at the quarterly meeting of the board of directors of the American Oil Burner Association, held July 13.

Lionel Jacobs, president of the association, in discussing patents, drew attention to the patent difficulties through which other major industries have passed, and the necessity for settling disputes about patents within the industry itself, thereby avoiding unnecessary expense and doubt in manufacturing. This method of settlement, he pointed out, would be of substantial benefit, not only to the industry itself, but to the users of oil-heating equipment. The cost and uncertainty of patent disputes, he stated, has not only held back many large industries, but actually has forestalled full confidence on the part of the public in the industry itself.

In discussing the desirability and necessity for co-ordinated and uniform laws and regulations governing the installations of oil-heating equipment, Rufus Richart, assistant director of the Oil Heating Institute, pointed out that the uncertainty and variation of the rules and ordinances in different States impose production problems on manufacturers which unnecessarily raise the cost of oil-heating equipment to homeowners. If the laws and regulations affecting the installations of such equipment were uniform, he stated, the future users of oil-heating equipment would benefit most, just as all consumers have benefited whenever it was possible to turn out standard products for the largest number of consumers.

Regarding the standards of installation methods of oil-heating equipment, it was the opinion of the meeting that this phase of the industry is continually improving, but that the highest quality of service in this connection could only be obtained by the whole-hearted co-operation of manufacturers, distributors, dealers and consumers.

Following the meeting, the board of counsellors of the Oil Heating Institute approved the proposed plan for extensive advertising in local newspapers throughout the country. This advertising will be in addition to the advertising which the Oil Heating Institute is now carrying on in national magazines. It was the opinion of the counsellors that, however effective the advertising in the national magazines may be, the fullest opportunities for educating the American people in the most comfortable methods of home heating could be obtained only through advertising in the local newspapers in which each community has complete confidence.

Oil-Burning Research at Johns Hopkins for the Oil Heating Institute

Announcement is made by the Oil Heating Institute, of research work to be conducted during the summer at Johns Hopkins University, Baltimore.

This is the first time that a well-co-ordinated investigation into the air-fuel ratio, shape and size of combustion chamber, possible draft variations, and methods of mixing fuel in domestic oil burners has been planned by non-commercial authorities.

The institute plans to make a fundamental study of the general problem of combustion in an oil flame. The influence of all the possible variations, such as type of fuel, method of mixing, air-fuel ratio, shape and size of combustion chamber and relative heat efficiencies will be studied. Losses due to incomplete combustion will be carefully tabulated and analyzed. The results will be used by oil-burner manufacturers who are members of the Oil Heating Institute. Accurate knowledge of the most efficient grades of oil fuel will be conveyed to approximately half a million people in the country using this type of domestic heating.

The research work will be conducted by Theodor Theodorsen of the Johns Hopkins faculty. Mr. Theodorsen is one of the leading authorities in the United States on combustion and drafts. He received his diploma in engineering from the Technical University of Norway, at Trondhjem, in 1922. The following year he had a fellowship for research at that university, and conducted original experiments for the Norwegian Government in the field of air, steam and water pressures.

Committees Appointed for 1927-8

The scope of association activities is revealed in the following list of committee appointments for the present year:

Executive Committee: Lionel L. Jacobs, Edwin M. Fleischmann, Leod D. Becker.

Committee of Finance and Budgets: Walter F. Tant, chairman.

Committee on Research: Marc Resek, Arthur H. Senner, H. A. Kunitz, Harry F. Tapp.

Constitutional Committee: Edward P. Bailey, chairman.

Committee on General Trade Practices: Edward M. Fleischmann, chairman.

Membership Committee: George P. Kittel, chairman.

Committee on Design and Installation Standards: W. M. C. Kimber, chairman.

Committee on Co-operation With Underwriters' Laboratories: L. H. Van Ness, chairman.

Committee on Electrical Motor Specifications: Karl B. Seegal, chairman.

Committee on Patents: C. H. Chalmers, chairman.

Committee on Uniform Ordinances: B. F. Geyer, chairman.

Committee on Uniform Oil Specifications: Harry F. Tapp, chairman.

Committee on Co-operation With Heating Industry: P. E. Fansler, chairman, Homer R. Linn, Edwin M. Smith, George Wright, F. W. Hvoslef, L. B. Spafford, John H. McIlvaine, R. C. Hay.

Chicago Oil Burner Association Is Incorporated

Announcement of the incorporation of the Chicago Oil Burner Association, under the laws of the State of Illinois, was made at the July meeting, held at the Allerton Club. Sixty-nine members and guests were present. The association has steadily gained in strength, and has become a real factor in stabilizing the oil-burner business in Chicago and its vicinity. It is now joining with the oil and garage interests in the presentation of a resolution to the city council and authorities, looking toward a more satisfactory code and a fairer permit rate.

Chairman Cress of the publicity committee spoke on the new billboard advertising fund, and reported a highly successful campaign for advertising in the forthcoming association booklet and directory.

How Not to Get Results in a Heating System

The president of a large instrument company employed a plumbing contractor to remove a direct radiator installation and to install a small gravity indirect-heating system.

When put into operation, the system gave but fair results, although the cost was much greater than expected. The factory president was greatly disappointed with the general plan of the apparatus, especially with the unnecessary length in the air-ducts and the multiplicity of turns. The design did not display the directness and smoothness to which he was accustomed in the design of his own product.

A consulting engineer was called in to pass upon the installation. The engineer asked who did the planning and whether there were any drawings and specifications. The president, although a man with some 50 years of experience in industrial plants, including the manufacture of delicate instruments, evinced some surprise at the thought that any particular planning or engineering was necessary for a heating system, admitting that there were no plans or specifications, and that the mechanic who did the work was a plumber and not a steamfitter.

Who did the planning?

This question comes up so frequently in the investigation of equipment that does not function properly, that it has become evident that effective heating, ventilating, and air conditioning for plants starts with the manufacturer's attitude toward the planning.

Important questions of human relationships are involved. Without the right mental attitude and a will for the best results, without the appreciation of the necessity for bringing adequate knowledge to bear on the problem, failure is likely to ensue.

The consulting engineer's analysis of the situation was something like this:

"Mr. President," he said, "as we look at this piece of work, it is clear that it is a good mechanical job. The work is plumb and true, the curves are smooth and easy, the joints are well seamed and tight, the safing off around the radiators is well done, and there are tight connections to air intakes, registers, steam supply, and returns.

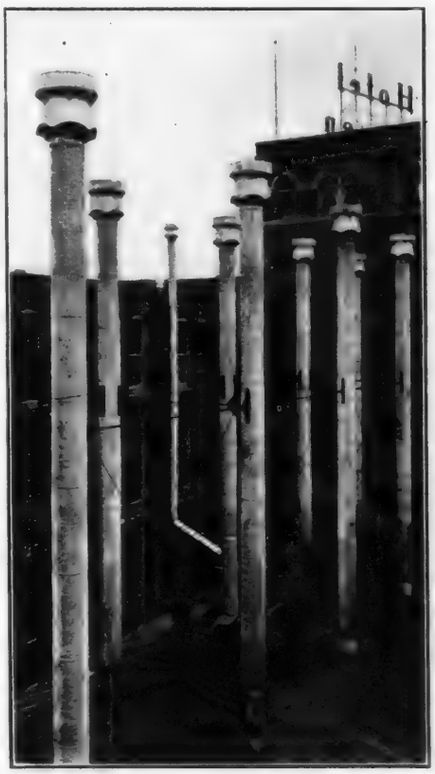
"But, isn't this, Mr. President, about as far as you should expect a mechanic to go? I am frank to say that I am surprised that a man of your many years of experience with mechanics and engineering should ever expect a mechanic, or even a contractor, to figure up, lay out, and install a complicated indirect-heating apparatus without engineering assistance. In all of your experience, I do not believe you ever started to manufacture a new product by taking a rough sketch to one of your mechanics, and after explaining to him that you wanted it made just so, in perfect mechanical and electrical balance, graduated to a certain scale, and so forth, that then you expected him to produce the desired results.

"No," continued the engineer, "your engineering department figures a design carefully, then your drafting department makes details of every part, even to the numbers of threads for every nut and screw. Not until then, Mr. President, do you turn the job over to your mechanics, who even then, if not especially trained in your particular shop, will make a failure of your new instruments.

"I believe, Mr. President, that under the circumstances you have got about as much as you should have expected." —PERRY WEST in *Factory*.

Gang of Ventilators Serve Shut-In Building

The use of natural currents of air to provide ventilation through the medium of rotary-siphoning, and other types of ventilators, has much to commend it in the way of simplicity, low first-cost and almost zero operating cost. An interesting example is found in a battery of ventilators on the station of the Kansas Gas and Electric Co., Wichita, Kans. This building is surrounded on all sides by other and higher buildings, making it necessary to erect ventilators on long extension-stacks in order that they might function properly.



Ventilators on the Kansas Gas and Electric Co., Wichita, Kan., Carrying Escaping Air Above the Inner Court of the Building to the Open Air Above

The Trend Toward Better Oil-Burner Selling Talk

Two exceptionally fine examples of oil-burner sales literature that have been received from prominent manufacturers indicate that a definite trend toward reasonable, accurate, and yet forceful sales presentation has stepped in. One of the booklets "How To Select An Oil Burner" presents the story from the point of view of the Gulf Oil Burner Co., Philadelphia, and the other "Shall I Heat My Home with Oil Fuel?" represents the view of the Frank A. Holby Corp., New York.

It might be said that each of these booklets is divided into two parts. The first designed to sell the idea of the use of oil fuel and the second calling particular attention, in the one case, to the Grant Gulf burner and, in the second case, to the Holby equipment. The text of both is notable for accuracy of statement and freedom from exaggeration, and these sections properly could be used as advertising matter for any of the better class of oil burners.

In the Grant Gulf booklet, the appeal is made on the basis of the solidarity of the interest of the nationally-known Gulf Refining Company, with which the Gulf Oil Burner Company is associated. This booklet also contains a brief, yet comprehensive, technical story of the Grant Gulf burner. The background of the Holby booklet is what has been termed "Holby Guaranteed Oil Heating." The burden of this story is the financial strength and engineering ability represented by the Frank A. Holby Corporation and a determination of this organization to handle each individual installation as a single problem and unqualifiedly to guarantee its successful operation.

These booklets are a departure from the loose sales talk that characterized so much of the oil burner literature of a few years ago, and unquestionably consumer sales resistance will materially be decreased through the circulation of literature of this kind.

OIL HEATING, THE MODERN MIRACLE OF COMFORT is the title of one of the first publications issued by the Oil Heating Institute, New York. Twenty-four pages of this bulletin are devoted to data on comparative costs of coal and oil; the safety and reliability of oil burners; oil-fuel supply and demand, under which is quoted a report of the U. S. Bureau of Mines showing the tremendous, potential, undeveloped oil area; the essential points in selecting oil-heating equipment; and a section answers questions that most frequently are asked on the general subject of domestic heating with oil. The last thirty pages of the book are devoted to advertisements of oil-heating equipment made by manufacturers who are members of the Oil Heating Institute. Size 5½ in. by 8 in. Pp. 78.

Legal Decisions

Lessor's Duty to Repair Radiators Under Lease Provisions

A lease of an apartment contained a provision exempting the lessor from liability for damages resulting from "leakage of Croton or other water, steam, or gas, from or into any part of said building, or from any other cause in any event." It contained other provisions relieving the lessor from any responsibility for the care, maintenance, or supervision of the premises, or "of any of the pipes, fixtures, appliances or appurtenances therein contained." In an action by the tenant for damages caused by steam escaping from the radiator in the apartment, the New York Supreme Court, Trial Term, New York County, said, Kessler v. The Ansonia, 221 New York Supplement, 488, that: "These provisions apparently created a limitation on the liability of the defendant for damages resulting from escaping steam. In construing the language of similar leases the courts of this state have held that exemption from liability applies only where the lessor is free from affirmative acts of negligence. E. C. Lewis Co. v. Metropolitan Realty Co., 112 App. Div. 383, 98 N. Y. S. 391, affirmed 189 N. Y. 534; Dreschler-Rothberg Co. v. Landeker Co., 140 N. Y. S. 1025.

"The evidence in the case at bar is substantially to the effect that plaintiff noticed the steam escaping for some time before the day on which her property was damaged, and that she notified defendant on several occasions, and, although employees of defendant attempted to remedy the condition on one occasion, steam continued to escape. It cannot be urged, in the light of the New York cases, that the provisions in the lease in question relieve defendant from the obligation to inspect the steam system over which plaintiff had no control other than to shut off or diminish the amount of steam supplied in the radiators in her own apartment, or that defendant was under a duty—steam plant being under the defendant's control—to make the necessary repairs.

"In the case of Dreschler-Rothberg Co. v. Landeker, supra, the learned trial justice says:

" 'The tenant cannot repair the parts of the building in the landlord's control, and it was obviously the intent of the parties that the landlord should continue to make these repairs. If he is negligent in making them when called to his attention, the lease should not be interpreted as exempting him from liability.'

"Likewise, in the instant case, the apparent neglect on the part of defendant to properly repair the defective condition of the radiator after due notice by the plaintiff constituted negligence for which the defendant is liable. The amount of the damage sustained by the plaintiff was not contested on the trial. No proof was offered by the defendant to offset the evidence propounded by the plaintiff."

Verdict and judgment for $5995 were rendered for the plaintiff.

Contract for Installation of Heating System a Construction Contract

In an action for the balance due under a contract for the furnishing and erection of a heating system in a new building, it appeared that the contract, which was for a blower system, described specifically the kind and style of fan, motor, pipe coil heater, air washer with pump and motor, reheater coils, condensation system, duct system and steam piping to be used; contained the usual clauses found in building contracts, and guaranteed that when the system as installed by plaintiff was operated in accordance with its instructions, and the heater coils furnished with sufficient steam at 80 lbs. pressure, the average temperature in the offices would be not less than 70° F. and in the rest of the factory 60° F. in zero weather. This was the only guarantee in proposal or contract.

The defense was that the plaintiff knew that the heating plant was to be erected in the building of a company engaged in the business of manufacturing high class woodwork, victrola cases, radio cases, fine store fixtures and high-class interior finish for buildings, requiring high-class varnishing and polish, and that the manufacturing plant was to be constructed with sufficient provision for protection against dust and dirt which would damage their products; that the plaintiff has designed a heating system which should exclude practically all air with the exception of that which would enter the plant through the heating system; and that the plaintiff had represented to the manufacturing firm and to the defendant which was constructing the building, that the system so designed to be installed by it would furnish, in addition to heat, washed air for ventilation, and that this washed air would provide perfectly clean air in winter and cool fresh air in summer, and that in reliance on this representation the contract had been entered into, calling for the air washer included in the plaintiff's proposal. Affidavits set forth that the system as installed did not provide clean *dry* air but contained such an amount of moisture that it damaged the fine woodwork manufactured in the building, and caused injury to the walls of the building because of the excessive humidity, resulting in damage to the manufacturing company in excess of the balance unpaid on the contract, and that the plant could not be operated so as to furnish the required clean dry air without alterations costing more than such balance.

The Pennsylvania Sales Act, and the section thereof relating to warranties (providing for an implied warranty of fitness for an expressed purpose) was held not to apply to the contract, which, it was held, was in no sense a contract of sale under that statute, which defines a sale of goods as an agreement whereby the seller transfers the property in goods to the buyer for a consideration called the price, and a contract to sell goods as a contract whereby the seller agrees to transfer the property in goods to the buyer for a consideration called the price. The contract in suit was held to be a construction contract. "The transfer of property in the fan, motor, pipe coil heater, air washer, reheater coils, condensation system, duct system and steam piping was but incidental to the main purpose, which was the furnishing of labor and the assembly of material in the erection and construction of a heating system. It would be just as proper to call a contract for the construction of a building a sale of the stone, brick, cement, wood, etc., which entered into the erection of the building. This plaintiff took specified materials and apparatus, manufactured and supplied by various dealers, and by assembling them and connecting them into a system designed by the engineers constructed a new and different unit, a completed heating system. The operation was one of building, or construction, not of sale, within the meaning of the Sales Act aforesaid. Where a dealer sells a machine or similar apparatus and the setting up or installation is but incidental to the sale, as in Farr v. Zeno, 81 Pa. Superior Ct. 509, (the sale and installation of a carbide generator), the Sales Act applies; but where as here the contract is really a building or construction agreement, and the furnishing of material and apparatus is merely an incident thereto, the Sales Act has no application.

"We have then a written contract for a heating system, guaranteeing the temperature which it will maintain under certain conditions, but containing no covenants, representations, or warranties as to the humidity of the air; no allegation that any such representations were omitted from the contract by fraud, accident or mistake. The rule applies that the written agreement must be held to be the entire contract between the parties, since the subject of the alleged oral representations would naturally and normally be included within the terms of the heating contract, if they had been intended to form part of the agreement between the parties."

Judgment for defendant was reversed and ordered to be entered for plaintiff. York Heating Co. v. Flannery, 87 Pa. Superior Ct. 21.

Master Plumbers Take Stand on Direct Selling

A LARGE volume of important business was transacted; relations between manufacturer and retailer were cemented, and the tie-in with the National Trade Extension Bureau was strengthened at the annual convention of the National Association of Master Plumbers in Minneapolis, June 21-23. Over 3000 were in attendance. Unanimity in the selection of officers was evidenced in the election of Thomas F. Nolan, Albany, N. Y., as president; Jere Sheehan, Jr., St. Louis, vice-president; A. C. Eynon, Canton, O., treasurer, by a single ballot which the secretary was instructed to cast. Mr. Nolan immediately appointed Frank E. Schimpf, Albany, as national secretary.

After a spirited contest between advocates of Memphis, Atlantic City and Buffalo, the ultimate decision was that Memphis be the convention city for 1928.

The convention endorsed the National Trade Extension Bureau's plan calling for a yearly expediture of $500,000 to be apportioned according to a definite plan, with the largest amount allotted to national advertising. It was also the sentiment of the meeting that the term "merchant plumber" be deleted from all literature issued by the bureau.

ORGANIZED INSTALLMENT-PLAN SELLING DISCOURGED

The National Trade Relations Committee was supported by the delegates in the resolution opposing the selling of plumbing on the present-day installment plan as practiced by other business organizations, leaving it a matter of individual decision. The same committee recommended that all wholesalers of heating and plumbing supplies prominently display signs "Wholesale Only," which met with hearty concurrence.

Relations between the manufacturer, wholesaler and retailer were clarified through the adoption of the following suggestions submitted by the Trade Relations Committee:

"The committee discourages the practice of their (manufacturers') low-powered salesmanship in visiting contractors and retailers, and encourages efforts along proper lines to interest prospects and architects by explaining and demonstrating the merits of their goods.

"The committee discourages manufacturers and wholesalers from furnishing engineering service in designing layouts and compiling specifications for the installation of heating and plumbing systems. The furnishing of this engineering service is the business of certified engineers and the heating and plumbing contractors.

"The committee suggests the contacts as between the manufacturer and wholesaler; wholesaler to heating and plumbing contractors and retailers.

"The unethical practice of wholesalers submitting one price on heating and plumbing materials for competitive work before a contract is awarded, and a lower price after contract has been let, and without the knowledge of the successful contractor, arouses suspicion and destroys the judgment of the contractor and the morale of business."

DEMAND FOR LOGICAL BOILER RATING

The Michigan State Association submitted a resolution calling upon the national association "to use its best efforts and influence to have the manufacturers of heating boilers rate their boilers at their capacity by test as to what load they will carry with different firing-periods." While the committee did not accept the resolution, it approved the principle, and the matter was referred to the Standardization Committee.

EXHIBITS

The exhibits, held in conjunction with the convention, were situated in the new Minneapolis Auditorium. They were arranged around the room directly below the auditorium. Among the ninety-four exhibitors were:

American Radiator Co., New York, with a characteristic display of boilers, radiators and water heaters, under the direction of John J. Ney, assistant manager of the Minnesota branch.

Bell & Gossett Co., Chicago, displaying a water-heater so arranged that the circulation of water was visible. E. J. Gossett was in charge.

Chicago Pump Co., Chicago, featuring bilge and sewage pumps in operation. M. I. Weil, president of the company, was in attendance.

Cleveland Gas Burner & Appliance Co., Cleveland, showing gas burners set up so as to demonstrate the principles of construction, and the adaptability of the various sizes to boilers of different types and shapes. President Harry E. Kerr presided.

Excelso Products Co., Buffalo, exhibiting a line of indirect water-heaters, firepot heaters and generators. The display was under the supervision of C. W. Farrar, president.

Hoffman Specialty Co., New York, displaying radiator valves, vacuum and air valves, traps, gauges, damper regulators, and the Hoffman controlled-heat system. E. S. Storm, vice-president, was at the head of a staff of attendants.

Ironton Bernhard Boiler Co., Ironton, O., showing a boiler, cut away to make visible the features of design and construction. President J. B. Bernhard headed the group in the booth.

Jenkins Bros., New York, whose booth was attractive with a display of valves, assembled and disassembled, all mounted on a contrasting background. This booth was in charge of M. D. Neeley.

Kewanee Boiler Co., Kewanee, Ill., exhibiting boilers, water heaters and garbage incinerators, in charge of H. J. Sperzel, manager of the Minneapolis branch.

Minneapolis Heat Regulator Co., Minneapolis, Minn., showing an illuminated model of the new factory, and demonstrating working models of the controls developed for coal, oil and gas-fired heating plants. President W. R. Sweatt headed a group comprising all of the officers of the company.

National Trade Extension Bureau, Evansville, Ind., which had the feature exhibit in the shape of a full-sized model heating and plumbing display room, with show windows, the contents of which were changed daily. This constructive exhibit was an eye-opener to many of the delegates, and strikingly illustrated the possibility of arranging heating and plumbing equipment in attractive displays.

National Tube Co., Pittsburgh, Pa., whose display included models of pipe-making machinery and photographs taken in the big mills at Pittsburgh. J. M. Denny, of the home office, was in charge.

Richardson & Boynton Co., New York, exhibiting boilers and water heaters, under the direction of G. G. Zingsheim, manager of the Minneapolis office.

United States Radiator Corp., Detroit, Mich., displaying some of the new-type radiators, and round heating-boilers. The exhibit was in charge of W. N. Parke, manager of the Minnesota branch.

Weil-McLain Co., Chicago, featuring cut-away models of round and rectangular sectional boilers, the latter being of the self-feed type. Martin Weil was in charge.

"X" Laboratories, New York, had an exhibit of "X" boiler liquid. Those representing the company were: J. W. Gannon, E. W. Sanborn, W. M. Ireland.

CONVENTION EXCEPTIONALLY WELL HANDLED

The manifold difficulties of conducting a convention and exhibition such as that at Minneapolis where an exceptionally large group congregated, only may be appreciated by those who have gone through the experience of handling a similar undertaking. The Minneapolis convention was directed by W. J. Lang, of Chicago, and all reports concur in the statement that he and his aides, selected from the Minnesota association, omitted nothing in providing smooth sailing for the many attendants. Even automobiles, furnished by the committee, replaced taxis in transporting visitors to and from depot, hotel, and convention hall. Mr. Lang was given a well-deserved vote of appreciation by the convention for the many attractions provided for the visitors.

New Apparatus and Appliances

Air-Conditioning Units—A New Development

Air conditioning is following in the footsteps of the more simplified ventilation, as is evidenced by the announcement of air conditioning by the unit system.

The York Heating & Ventilating Corp., Philadelphia, Pa., has placed upon the market a series of units having capacities ranging from 750 cu. ft. per min. to 10,000 cu. ft. per min., designed automatically to provide defined atmospheric conditions as required.

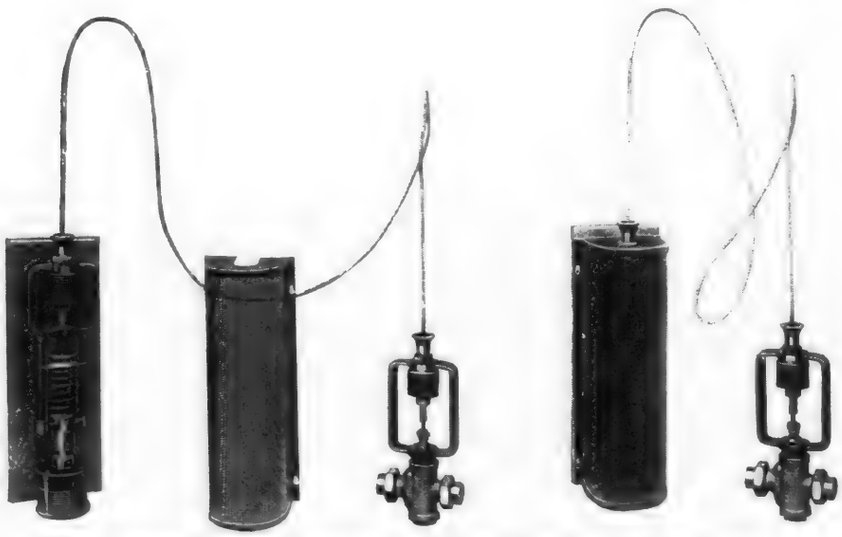
This equipment especially is adapted to the small factory where the comparatively high cost of a central air-conditioning plant has precluded its use. Proper temperature, humidity and air circulation can be obtained by setting the unit on the floor, connecting it to steam, water and electric service, and locating the automatic controls at the proper point.

These new units resemble, in general outline, the unit heaters manufactured by the same organization. There are mounted on the end of the housing a centrifugal pump driven by an electric motor, a water strainer and heater, and the necessary controls.

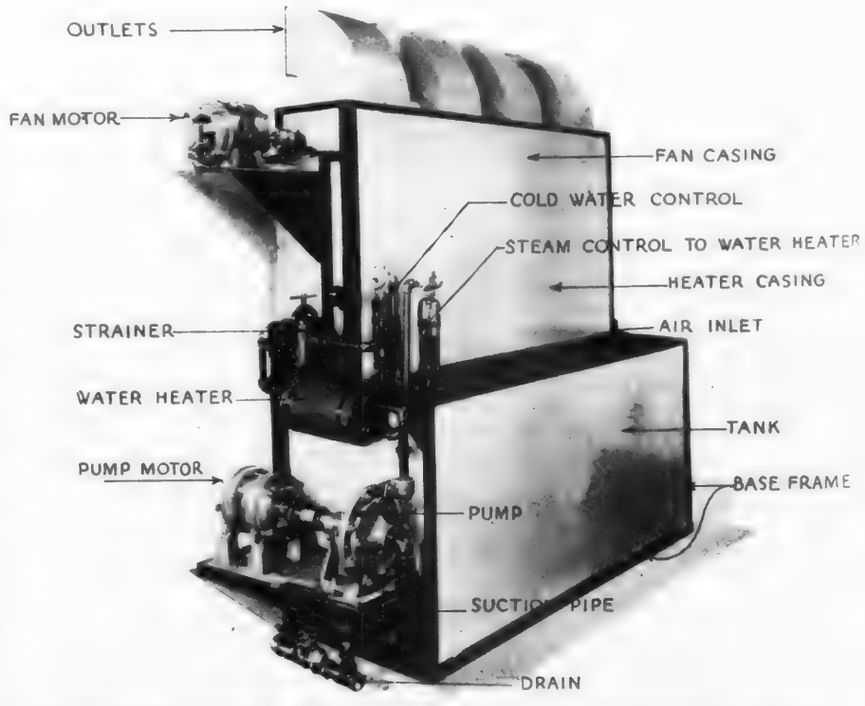
Air is drawn into the unit and passed successively through two spray chambers, in which moisture is added. After leaving these, the air is passed through a series of eliminator plates which remove suspended moisture. Thence the air is passed over the heating coils which raise its temperature to the point determined by the control thermostat. The pair of fans, characteristic of York unit-heaters, then exhausts the air, at high velocity, in a horizontal sheet above the heads of the workers.

Where de-humidifying is required, a connection is made to a cold-water supply, the water either being refrigerated or taken from a natural source. The air, in passing through this chilled water, is cooled and automatically forced to give up excess moisture, and relatively dryer air is blown out by the unit. The degree of humidity of incoming air, whether greater or less than wanted, is changed by automatic controls to conform to the desired standard.

Room temperatures can be maintained within 2° F., and humidity controlled within 2%. It is stated that, with this system, the temperature variation, from floor to roof, usually is less than 1° per ft. of height.



Distant-Control Mechanism for York Air-Conditioning Units

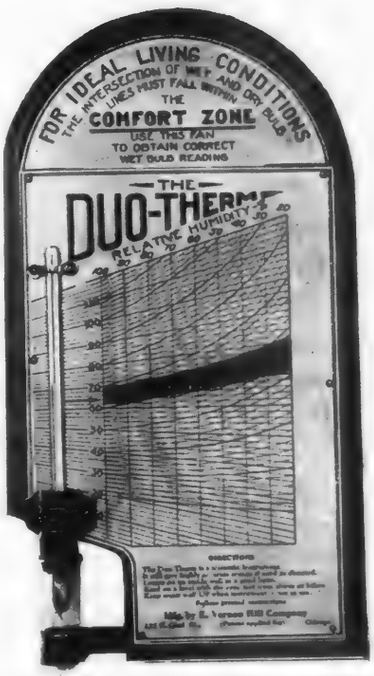


York Air-Conditioning Units Provide Controlled Temperature, Humidity and Air Movement

The Duo-Therm, a New Type of Thermometer

Difficulties in the use of dry and wet-bulb thermometers by the average householder are well known. The accumulation on the exposed wick of dust and dirt is perhaps the most frequent cause of inaccuracy, although another cause easily may be the lack of agitation of air around the wet-bulb instrument. To meet these objections, the E. Vernon Hill Co., Chicago, Ill., has perfected an instrument known as the Duo-Therm, consisting of a thermometer mounted on a panel containing a combined chart and thermometer scale. In addition to the wick for the thermometer bulb, a rubber stopper has been provided just above the bulb and a glass water well beneath. The normal position of the water well containing the water is up, that is, attached to the stopper.

When the wet-bulb temperature is to be determined, the well is lowered and the wick fanned with a fan carried in a pocket behind the panel. The chart itself is made of Bristol board, treated with an invisible water-proof varnish.


FOR IDEAL LIVING CONDITIONS
THE INTERSECTION OF WET AND DRY BULB LINES MUST FALL WITHIN THE
COMFORT ZONE
USE THIS FAN TO OBTAIN CORRECT WET BULB READING
THE
DUO-THERM
RELATIVE HUMIDITY

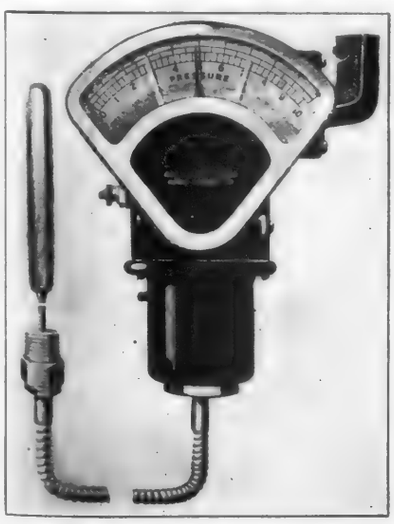
This Duo-Therm Shows Whether or Not Atmospheric Conditions Fall Within The Comfort Zone

One of the features of the instrument, it will be noted is its use either as a dry or wet-bulb thermometer. When the water well is up dry-bulb temperatures are given and, when the well is down, wet-bulb temperatures.

Another important feature incorporated in the instrument is a simplified form of psychrometric chart embodying the "effective temperature" and "Comfort Zone," as determined by the A.S.H. & V.E. Research Laboratory tests. A circular accompanying the instrument explains in detail how to use the Duo-Therm. The instrument is listed at $2.75.

Honeywell Brings Out Two Devices

Combining the functions of a temperature-range limiting device and a safety check against firing a dry boiler, when an intermittent oil burner is used, the new Type A Masterstat represents the latest achievement of the Honeywell Heating Specialties Co., Wabash, Ind.



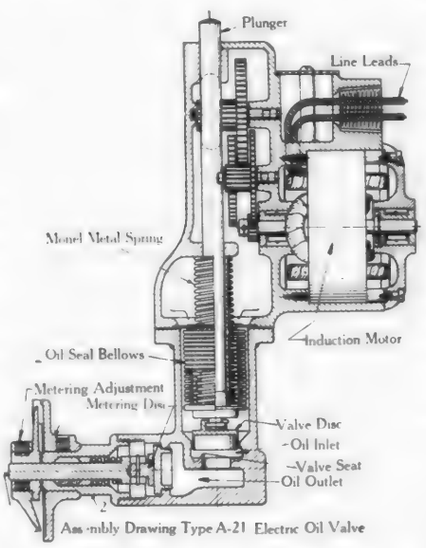
Honeywell Masterstat

This instrument functions to meet the requirements of a section of the latest Underwriters' regulations which reads:

"It is recommended that where automatic regulation is provided by means of a room thermostat, the installation should be equipped with an additional thermostatic control to prevent abnormal steam pressure, or overheated hot-air furnace ducts. Such automatic shut-off device should be so arranged that it must be reset manually."

Masterstat consists of a cylindrical casing above which is a fan-shaped dial. Two limiting hands move over the dial and can be set from outside of the case. The index hand moves between the limiting fingers. The dial may be had in any one of several calibrations, for steam, vapor, hot-water or warm-air. The operating element is located in the base, and is expanded by heat transmitted from a thermostatic bulb located at the end of a hollow tube. In making the installation, the Masterstat is mounted on a convenient bracket near the top of the boiler, and the bulb is introduced through a ½-in. hole drilled through the boiler casing, and is pushed through until it rests on the crown sheet near the center of the boiler.

Heating and cooling of the bulb is transmitted to the Masterstat, causing expansion and contraction of the operating element. The room thermostat is connected to the oil-burner motor through the Masterstat. If the temperature of the crown sheet should exceed that for which the limiting dial finger is set, the motor circuit will be broken, and will so remain until manually reset. Demand for heat by the room thermostat will have no effect upon the motor, as its circuit already is broken. Should an emergency occur and the instrument fail through any cause, such failure will trip the line-voltage switch, and the burner cannot operate until repair is made. The Masterstat thus acts as a differential control, provides against the firing of a dry boiler, and prevents dangers due to an electrical failure of any kind.

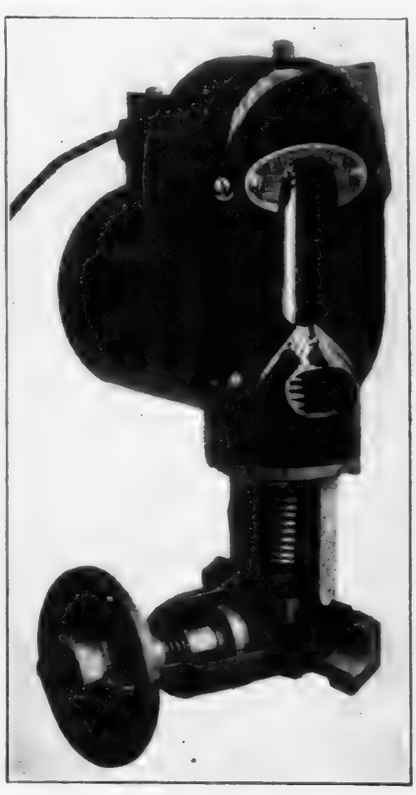


Section of Honeywell Motor-Operated Oil Valve

A motor-operated, positive automatic shut-off valve is another recent Honeywell development. Its construction and operation are simple. A miniature induction motor is geared through a high-ratio train to a rack forming an extension of the valve stem. The valve normally is held down, or closed, by a Monel spring exerting a 20-lb. pressure. The metal disc of special composition closes against a seat so shaped that dirt or grit passed by the strainer cannot prevent a tight closing. A seamless metal bellows is used instead of packing, maintaining a constant friction and a definite oil seal.

When the circuit is made to the valve motor, the rotor revolves, and, through the action of the gears and rack, the plunger is lifted. The valve then will remain open until its motor circuit is interrupted. While open the current consumption is less than 25 watts. The spring closes the valve when current is cut off.

In the majority of installations this valve motor is wired in parallel with the burner motor, which allows the valve to open when the burner starts and to close when it stops. If delayed opening or premature closing of the oil valve is desired this can be accomplished, in most cases, by controlling the oil valve motor through the motor switch.



Cutaway Honeywell Motor-Operated Oil Valve

New Venturafin Model

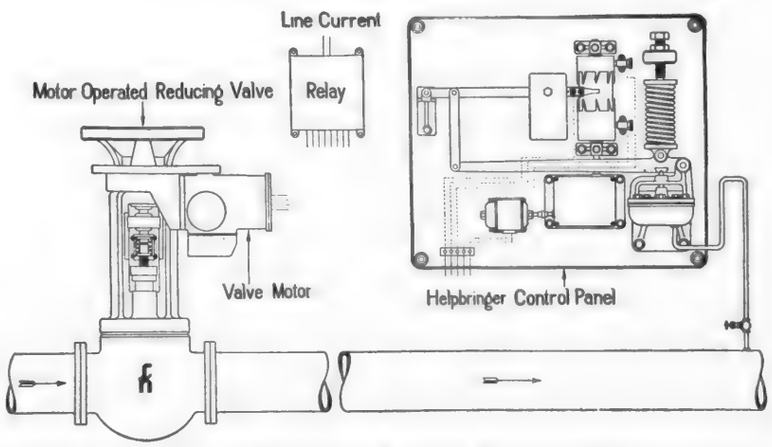
Announcing a new size Venturafin unit, American Blower Co., Detroit, Mich., has entered the field with a miniature assembly designed to provide for heating requirements from 125 to 200 sq. ft. equivalent cast-iron radiation. Like the larger sizes, the unit consists of a brass extended-surface radiator with its fan and motor in a single housing occupying a space 14⅜ in. wide, 14 in. deep and less than 22 in high. This unit is shipped complete in a carton. The design is such that recirculation of the room air can be secured through the use of a duct to the floor below the fan and heater element. Where the unit is placed on the inside of a building wall, it may be used to excellent advantage as a combination heater and ventilator. By providing an opening into the back of the unit and fitting this with a standard permanent

The New Small-Size Venturafin Unit

wall-fixture louver, air may be taken directly from the outside and tempered. By a similar arrangement, where the unit is placed in a dividing wall between the two rooms, by the addition of a through-register near the floor line, recirculation can be provided in both rooms.

New Franklin Gas Burner for Conversion Jobs

A new series of gas burners has been announced by the Franklin Gas Burner Appliance Co., Cincinnati, O. These are particularly designed for use in coal-fired furnaces and boilers where it may be desirable, for one reason or another, to burn coal during the peak of the heating season, and gas in the spring and fall. To meet these requirements the burners are designed to produce a high flame at the top level of the grate, and extending around the periphery of the combustion chamber. An arrangement is also made for the rapid and easy removal of the burner elements, so that the change-over of gas to coal readily can be made. Provision is also made for thermostatic control of the burner.



Schematic Diagram of Schutte & Koerting Reducing-Valve Control

Control of Motor-Operated Pressure-Reducing Valves

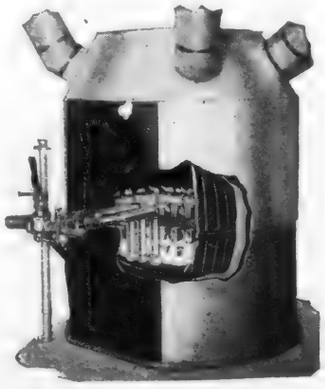
Control of motor-operated pressure-reducing valves, where the main valve must be located some distance from the point where reduced pressure is to be controlled, is provided in the Helpbringer electric control panel, which is announced by the Schutte & Koerting Co., Philadelphia. The panel, which is approximately 3 ft. long by 2 ft. high, is installed at some convenient point near the reduced pressure main and is connected to the main valve motor by three electric wires.

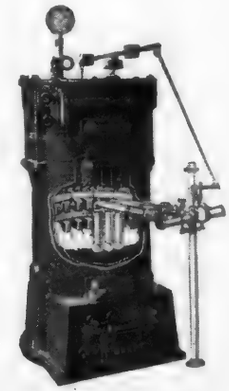
Essentially the control consists of a pair of insulated contact drums mounted on a vertical shaft and driven through reducing gears by a small high-speed electric motor which operates continuously. The drums turn very slowly, at about 2 r.p.m. A small pressure pipe connects the low-pressure steam main to a diaphragm chamber on the control panel, and variations in pressure in main are transmitted to the diaphragm and to a compound beam riding on the diaphragm and pivoted on knife edges. A compensating spring is used to balance excess pressure and a sliding weight permits adjustment of the beam. The floating end of the upper member of the beam carries an insulated finger that makes contact with the revolving drums. Each drum is fitted with a stationary brush contact connected through relays to the main valve motor. When the floating lever makes contact with the points on the upper or lower drum, due to increase or decrease in the pressure in main, there is a make-and-break action that produces intermittent applications of current to the motor on the main valve, closing or opening this valve to reduce or increase the flow of high-pressure steam until the pressure in the main has been re-established.

A slight variation in reduced pressure causes immediate operation of the main valve motor, but this operation is only momentary and just enough to open or close the valve a slight amount. The drums revolve so slowly that the main valve motor circuit is broken part of the time and the pressure in the main has a chance to re-establish itself. These are the steps that would normally be made in manually controlling a reducing valve; in other words, the main valve would be opened or closed a slight amount and the operator would observe the effect on reduced pressure, further opening or closing being made only if necessary. This feature eliminates "hunting" action.

A bulletin (8-R-17) issued by the company includes wiring diagrams and typical charts showing variation in steam flow and reduced pressure where the reducing valves were equipped with the Helpbringer control.

"AFCO" VENTILATING SPECIALTIES is the subject of a neatly-bound catalog received from the American Foundry and Furnace Co., Bloomington, Ill. Several types of grilles, dampers, diffusers and louvers are shown with accompanying text giving details.





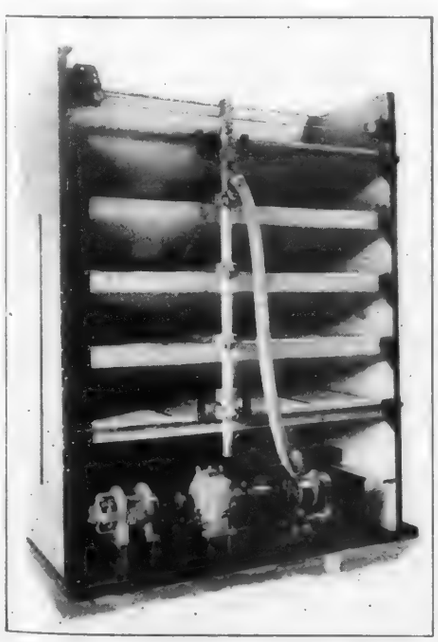
How Franklin Gas Burners Are Installed in Conversion Jobs

New Midwest Air Filter is Self-Cleaning

The newest Midwest horizontal unit-type air filters incorporate a feature of automatic cleaning that makes it unnecessary either to remove elements from the unit, or manually to clean them. This makes frequent cleaning cheap and easy, and insures practically a minimum and constant resistance through the filter for its entire lifetime.

Front of Self-Cleaning Midwest Air Filter

The filter is built up in standardized steel frames containing standardized and interchangeable cell units, laid side by side, and in layers one above another. Owing to the manner in which these frames are built up they can be adapted to almost any limited space-requirements within reason. Installations calling for either continuous or intermittent air-flow are provided for. Where the air flow is continuous, the filters are cleaned once a day by means of a time clock and load-carrying relay.



Rear of Midwest Air Filter Showing Automatic Cleaning Mechanism

The automatic washing device consists of horizontal spray pipes attached to a chain-driven carriage, so that under the chain drive they slowly move over the filter plates from end to end. An electric driven, high-pressure pump, located in the base of the washer, draws Viscosine from a tank extending under the entire washer, and forces it through slots in the spray pipes, removing the previous coating of Viscosine with its dirt, and leaving the cells coated with clean liquid. The washed-off material is collected in a trough, and drained to a settling tank for re-use. A flexible hose connects the fixed pump to the carriage to which the nozzles are attached. Installation plans for either continuous or intermittent air flow are provided. With a continuous air flow, filters are cleaned once a day by means of a time clock and load-carrying relay. The clock acts to clean one-third of the filter each day.

Where the air flow is intermittent, cleaning is seldom necessary oftener than once a week. Cleaning then can be accomplished in from three to fifteen minutes by means of a knife switch or push button, depending on the size of the motor and the current characteristic.

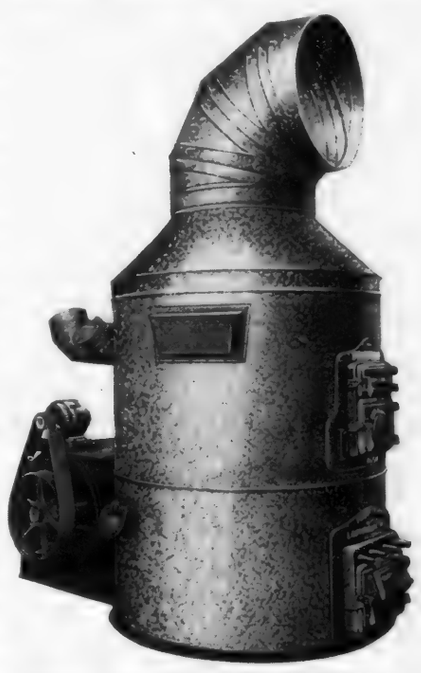
The cleaning nozzles, in the continuous filters, move at the rate of 8 in. per min., one movement across the cell being sufficient for cleaning. The flood pipe or nozzle extends across the full width of filter plates, and has, in its lower side, a slot approximately 3/16 in. wide. The oil coming out of this pipe is not a spray, but a solid curtain of Viscosine which thoroughly flushes every part of the screen in service.

Where the filter is continuously operated, a shield 8 in. wide, and extending the full length of the flood pipe, is placed over the top of the latter. This permits the oil curtain to flush down through the cell, unhindered by the air passing through the filter. The shield, being 8 in. wide, and moving at a speed of 8 in. per min. permits the surplus oil to completely drain through the filter before the full force of the air flow impinges on the screen. The shield thus insures complete cleaning of the cells while the filter is in full operation.

While the quantity of Viscosine used for each cleaning is tremendously high, it is said that the annual consumption is just the reverse, due to the low evaporation loss. The dirty oil, after it has passed from the filter cell, flows into a collecting trough at the bottom of each tier, and drains into a settling tank, where a natural separation of oil and dirt takes place. Here it is allowed to remain for a period ranging from three to six months, or a year, depending upon the dust concentration of the air passing through the filter. Chain-drive motors for moving the flooding pipe over the filter are 1/6 H.P. The pump motors are ½ H.P. per tier in height. The oil pump is made entirely of bronze in the smaller sizes, and with bronze gears and cast-iron housing in the large sizes.

Langenberg Enters Direct-Fired Unit Heater Field

Announcing the Front Rank unit heater for use in foundries, factories, garages, churches, schools, and residences, Langenberg Mfg. Co., St. Louis, has designed a unit with a maximum of direct heating surface, and through the use of two auxiliary radiators, or heat traps, the necessary secondary surface has been obtained. The entire unit is constructed of sheet steel, and there is not a single joint in contact with the fire. A Sirocco-type, duplex fan is provided, belt-driven by a motor mounted on the fan casing. Front Rank unit heaters, at present, are built in four sizes, having capacities from 155,000 to 735,000 B.T.U. per hour at the bonnet.



New Langenberg Direct-Fired Unit Heater

New Trade Publications

WORTHINGTON HIGH-EFFICIENCY CENTRIFUGAL PUMPS are described in detail in Bulletin No. W613 which has been issued by the Worthington Pump and Machinery Corp., 115 Broadway, New York. The bulletin also tells how 10,000 pump inquiries were analyzed to determine the heads and capacities most commonly specified by pump users. With this analysis as a basis Worthington engineers set about designing new lines of high efficiencies, especially for those heads and capacities.

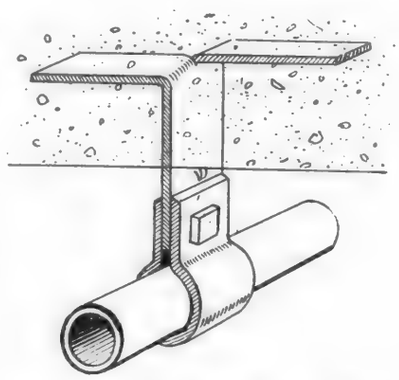
DIRECT CONTROLLED TEMPERATURE is the subject of a catalog issued by Direct Control Valve Co., Chicago, in which is described a thermostatic valve attached to the inlet of a radiator, designed automatically to maintain the room temperature at any pre-determined point. This temperature may be held at any point within wide range and, if desired, the adjustment can be locked so that changes of the setting can be made only by use of a special key. The valve is quick opening, packless, and contains no delicate parts. The operating element is of the hydraulic type, consisting of a helical spring of metal

Any Desired Room Temperature Can Be Maintained by This Control

tubing, in the axis of which is a metal tube containing a bellows-type expansion member. The lower end of the outer copper coil is connected to the interior of the bellows and the entire unit filled with non-freezing liquid and sealed at a definite temperature. The liquid in the container and in the flexible member expands when heated beyond the critical temperature and the expansion is transmitted through the inner tube to the valve mechanism. The catalog is well-illustrated with charts showing the operation of the control. Size 8½ in. x 11 in. Pp. 16.

BRYAN OIL-BURNING BOILER is described in a circular issued by Bryan Steam Corp., Peru, Ind. The circular outlines the company's long experience in building boilers for liquid fuel and contains an appreciative interesting testimonial from a local user of a Bryan boiler.

COMMONWEALTH PIPE HANGER INSERTS, especially designed for reinforced building construction, are a unique product illustrated and described in circular matter received from the Commonwealth



Commonwealth Insert, Showing Method of Hanging

Electric Co., St. Paul, Minn. The insert is T-shaped. When the concrete is poured, the T-shaped upper portion of the insert becomes firmly anchored, due to the inherent strength of the concrete itself, and also to the fact that the reinforcing rods can be placed underneath the prongs of the insert if necessary, thus virtually hanging the pipe from the reinforcing rods.

SMITH'S WELDING AND CUTTING EQUIPMENT of the oxy-acetylene type is presented in a folder listed as the 1927 Junior catalog of the Smith Welding Equipment Corp., Minneapolis, Minn. Size 3½-in. x 6-in. Pp. 32.

MERCOIDS, the periodical of the Federal Gauge Co., Chicago, contains, in its June issue, an article on The Future of Refrigeration, by Harold T. McDermott, editorial department, Ice and Refrigeration. Mr. McDermott tells an interesting story of the development of household iceless refrigeration, from which the following is quoted as being of particular interest to the oil-burner industry, whose development is closely paralleled.

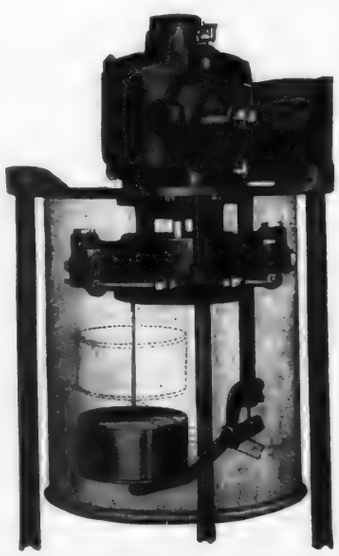
"As to the future of mechanical refrigeration, when it is realized that there are about 15,000,000 wired homes in the United States supplied with electric current, and that less than 3% of these have electrical refrigerating machines, it is apparent there is a large potential market for this product. About 12,000,000 iced refrigerators are in use in the United States at the present time.

Previous to	1923	20,000
Year	1923	20,000
Year	1924	24,000
Year	1925	75,000
Year	1926	260,000
Estimate for year	1927	600,000 to 800,000

"The gas-fired absorption-type household refrigerating machine is being rapidly developed at the present time. The cost of operation of this type machine can be considerably less than the cost of operation of the electrically-driven machine. There are about 17,000,000 gas meters in use in the United States."

DUNHAM DIFFERENTIAL VACUUM HEATING SYSTEM is the title of Bulletin No. 114, issued by the C. A. Dunham Co., 450 East Ohio St., Chicago, Ill., which describes the application to residences of the new system of heating recently announced by this organization. Full explanation of how this system operates, typical piping layouts, and charts for vacuum to be carried for various outside temperature are included. Another feature is the presentation of temperature and pressure-recording charts, showing tests made on actual installations equipped with the necessary apparatus for operating under this method. Size 8 in. x 11 in. Pp. 8.

MONROE OIL PUMPS are described in a folder issued by Monroe Machine Tool Co., Chicago. This folder features two types, designed automatically to provide a service supply for oil burners. One type, TJU, is a simplified design, furnished without legs, which are standard ½-in. pipe, cut on the job and inserted into sockets. The type TL pump is of more elaborate design and robust construction, with greater capacity, and is guaranteed for life.



Phantom View of Monroe Oil Pump

RESEARCH WORK OF THE CHROBALTIC TOOL COMPANY is discussed in a brochure issued by Chrobaltic Tool Co., Michigan City, Ind. An interesting story is told of the scientific studies made of the behavior of heat-resisting alloys for many purposes. In the booklet are some interesting views in this laboratory, one showing a set-up for making an autographic record of the fatigue values of certain oil-burner parts; another pictures an exhaustive experiment in the determination of relative thermo values of 14 materials. Size 8½ in. x 11 in. Pp. 8.

HOW MUCH OIL IN THE UNDERGROUND TANK? appears on the cover of a catalog issued by Morgan Gage Co., Rockaway, N. J. This catalog describes a distant reading gage radically different from other devices designed to perform the same function. The operation of this gage is shown in the accompanying illustration. Oil enters through the screened openings (a) and rises to the level of the oil in the tank. When the weighted piston (b) is forced downward by the weight (c) it covers the intake openings and thus traps the column of oil level with the contents of the tank. Shortening th trap by letting the piston descend as far as it can, causes the trapped oil to rise in the tubular piston rod (d).

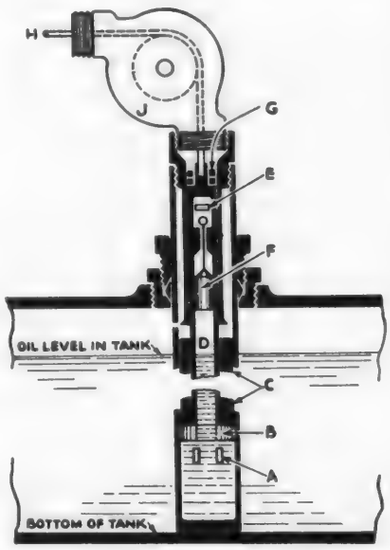
This forces air out through the opening (e) until the rising column of oil closes the valve (f). The trap will then be completely filled by the trapped oil which, being incompressible, prevents the piston from further shortening the trap.

The leather packing rings (g) seal the gage, preventing escape of oil or vapor, eliminating seepage of water into tank and permitting pressure test on tank with gage in place.

At each operation, the gage alternately sucks, then squirts oil through the intake of the trap, thus effectively cleansing the openings at every stroke.

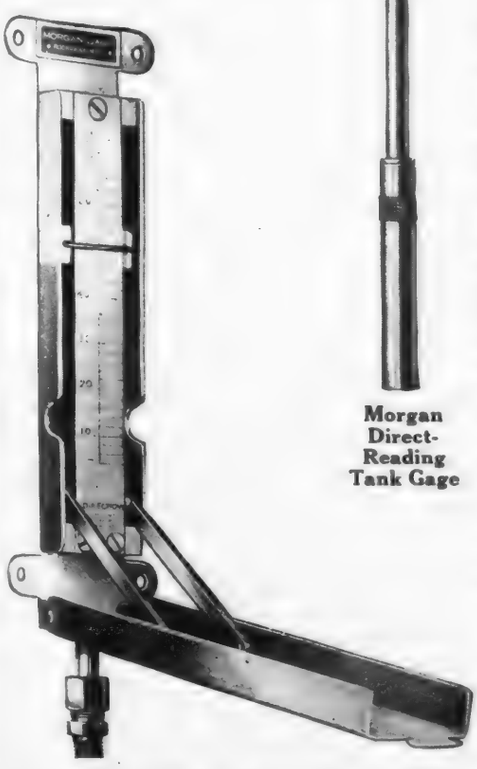
The distance which the piston can travel in filling the trap bears a known relation to the contents of the tank. All that is needed, therefore, is to transmit the motion of the piston to an indicator.

This is accomplished by positive mechanical means through a flexible rustproof cable of phosphor bronze passing over pulleys in specially-designed elbows that connect pipes leading from the tank to the basement. The cable passing through these pipes and around the pulleys is attached to the indicator which is fastened to the wall. The end of the cable is attached to the pointer on the indicator. To determine the contents of the tank, it is merely necessary to swing the scale cover forward by hand and read the figure at which the pointer stands. Means are provided for taking up any slack in the cable after it has been attached and the readings are accurate within a reasonable degree.



Actuating Mechanism of Morgan Distant-Reading Gage

Morgan Direct-Reading Tank Gage

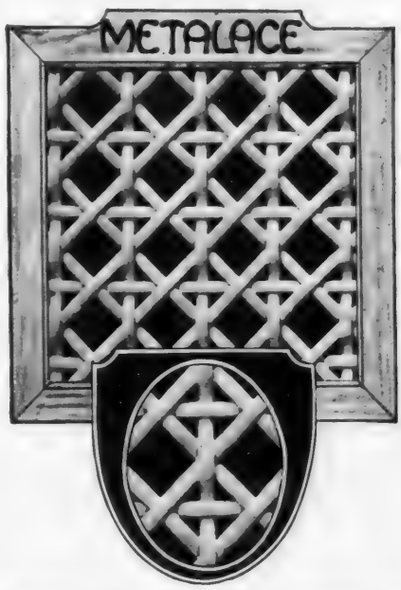


Indicator of Morgan Gage

BACHARACH MANOMETERS are described in Bulletin 131, issued by Bacharach Industrial Instrument Co., Pittsburgh. These manometers are distinctive in design and construction and are adapted to many purposes. They may be used to measure either pressure, suction or differential pressure. Oil is used as the operating liquid in the lower ranges and mercury in the higher. A new development designed as the magnifying manometer uses the two fluids with a tube having two diameters in such a way that the reading of the oil becomes practically a magnification of the mercury movement. A complete line of draft equipment consisting of draft gages and CO_2 indicators is also cataloged. Size 8½ in. x 11 in. Pp. 8.

UNIBLADE BLOWERS AND EXHAUSTERS form the subject matter of an elaborate catalog issued by Autovent Fan and Blower Co., Chicago. This is a typical, high-class technical catalog, well-illustrated, with dimensional line-cuts and photographs, together with unusually comprehensive performance tables. Size 8½ in. x 11 in. Pp. 48.

A REVELATION IN WOVEN METAL appears on the cover of an especially attractive catalog issued by the Metalace Corp., South Boston, Mass. In it there is told an interesting story of the invention, in 1920, of a method of weaving diagonal, multi-strand fabrics, beginning a new era in the art of weaving. In all past history fabric had been woven in two directions, at right angles. By the use of this new process it now is possible to produce grilles of woven metal, very closely simulating open cane weaving, and an almost infinite number of patterns seems available. This material, many patterns of which are illustrated with beautiful full-page photographic reproductions, is shipped in long rolls, which can be cut to required sizes and shapes with hand or standard machine-cutters. Metalace is manufactured of cold-rolled steel or bronze, and may be finished in a variety of ways. Size 8½ in. x 11 in. Pp. 32.

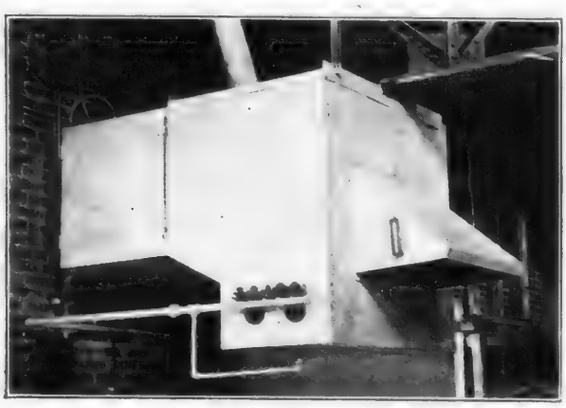


Portion of a Metal Grille Woven by the Metalace Process

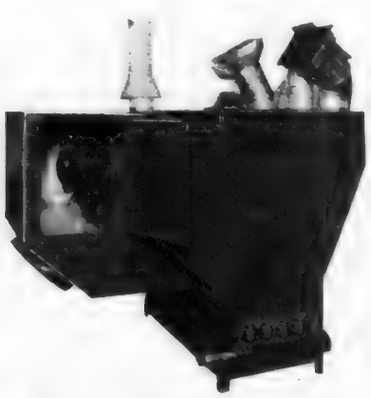
TRANE UNIT HEATERS of the industrial type are described in Bulletin 23 issued by the Trane Co., LaCrosse, Wis. This bulletin covers four sizes of heaters having capacities ranging from 450 to 7400 sq. ft. of equivalent direct radiation.

OXWELDER'S MANUAL has appeared as a new and ninth edition, published by the Oxweld Acetylene Co., New York. This volume is an excellent treatise on the art of oxy-acetylene welding in all of its branches and constitutes an exhaustive text book on the subject. There are 25 chapters, aggregating over 200 pages, and many illustrations of equipment, operations and completed jobs. An interesting chapter is devoted to the building up of special pipe fittings and manifolds through acetylene welding of sheet steel. Special chapters are devoted to the welding of brass, bronze, Monel, aluminum and other non-ferrous metals. Size 6 in. x 9 in. Pp. 216. Price $1.

STERLING GAS-FIRED UNIT HEATERS are described in a bulletin received from the Texo Sales Co., Inc., Cincinnati, O. These units are designed for ceiling mounting and consist of cast-iron combustion chambers with heavy gauge steel tubing, the unit being enclosed in Armco sheets. The units are vented to chimneys or stacks and provide for high-efficiency combustion. They are made in twelve sizes, having rated capacities from 15,000 B.T.U. to 535,000 B.T.U. per hour. The same circular describes the Sterling-Domestic, a gas-fired element with forced air circulation, for residential heating. This is thermostatically controlled and is built in six sizes rated from 300 sq. in. to 1300 sq. in. leader area.



Sterling Gas-Fired Unit Heater Supported on Roof Truss



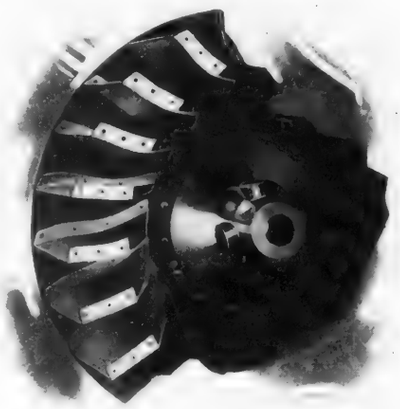
Side View of Furnace, Showing Fan with Service Door Open

HOW TO PUT OUT A FIRE is the title of an interesting little booklet being circulated by the National Fire Protection Association, Boston, Mass. After pointing out that fires are not all alike, the most common causes are grouped under three heads: First, ordinary (Class A) fires; second, fires in oil, greases, etc. (Class B); third, electrical (Class C) fires. Under the general heading, "Fire Extinguishers — What They Are—How They Work," the text and illustrations describe the more common methods of first-aid fire fighting.

THE WEATHER VEIN, issued quarterly by Carrier Engineering Corp., Newark, N. J., in its last issue affords Esten Bolling another opportunity to display his craft in "Blue Smoke." While primarily this is the story of the Carrierized factory of Bayuk Cigars, Inc., Philadelphia, Mr. Bolling in his inimitable manner has made it a fascinating tale of opportunity in the United States. The story begins with the dreams of a young cigar maker in Philadelphia some 30 years ago and tells of their fulfillment in this newest factory in which nearly half a million cigars are produced each working day. Of course the accomplishment is possible because in this factory, through the medium of Carrier equipment, "Every Day Is A Good Day." Like its predecessors, this issue of *The Weather Vein* should be read by all interested in air conditioning in industrial plants.

KAUFFMAN AIR DIFFUSERS are described in catalog No. 9 issued by the American Metal Products Corp., St. Louis, Mo. This company specializes in diffusers of different types for theatres and similar uses.

WEBSTER FEED-WATER HEATERS OF GENUINE PUDDLED WROUGHT-IRON are described in Bulletin No. 103 issued by Warren Webster & Co., Camden, N. J. Feed-water heating is a most severe service from the point of view of the materials used in construction. Alternate contact with water, steam, and air sets up, in most cases, a severe corrosive action. On the other hand alternate and too-frequent influxes of cold water and hot steam set up severe stresses. These two conflicting actions make the choice of material for shell construction one of vital importance. Warren Webster & Co., after a long and careful investigation, decided that real puddled wrought-iron would be best for this purpose, and in this book photomicrographs are shown to illustrate the reason for this choice. The catalog contains details of construction, illustrations of the heater in use, and complete dimensional information on the subject.



Double-Curved Blades That Characterize the Buffalo Conoidal Fans

BUFFALO CONOIDAL FANS are brought forward in an attractive catalog issued by the Buffalo Forge Co., Buffalo, N. Y. The text briefly presents the advantages in design, and characteristics of Buffalo double-curved-blade fans, as well as information on the application of these fans to heating and ventilating service. The catalog is profusely illustrated with photographs and line drawings, together with graphs showing the characteristics of Turbo and Duplex fans. There are also included general outlines with dimensions of the different sizes of fans in this series. Size 8½ in. x 11 in. Pp. 24.

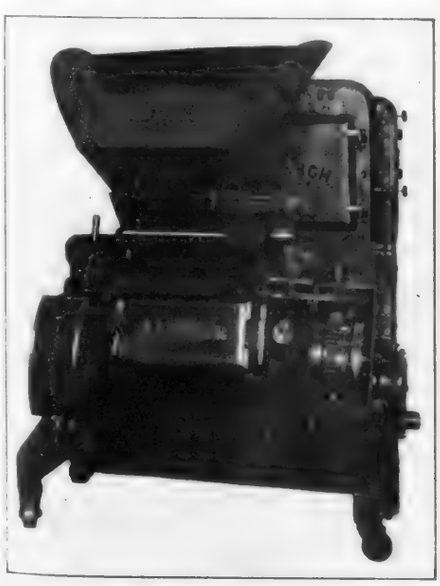
HOME AND WARMTH is the title of an attractive illustration appearing on the cover of a folder put out by the Rickard Engineering Corp., Fisk Bldg., New York. In it are described some benefits derived from the use of the Rickard oil burner. It is emphasized in the text that the Rickard burner has no one "big talking point," but that it is a carefully designed, constructed, and assembled burner, capable of providing heating comfort for the average home with little or no attention during the heating period.

IT COST $48 is used to draw the attention to a folder being distributed by the Pacific Steel Boiler Corp., Waukegan, Ill. Inside the sheet is a photograph of a residence in Birmingham, Ala. Beside it is a testimonial letter from the owner stating that during the past winter he burned six tons of coal, costing $8. per ton, to satisfactorily provide for 444 ft. of radiation.

TURN WASTE HEAT INTO CASH SAVINGS is the caption of the Bulletin No. 50 issued by Whitlock Coil Pipe Co., Hartford, Conn. This bulletin describes the Whitlock preheaters, and there is presented a duplex recording-thermometer chart, showing temperatures of water entering and leaving a Whitlock two-stage preheater installed in a laundry. This reproduction practically tells its own story.

HIGH CHIMNEYS COST MONEY—PITS ARE EXPENSIVE appears on the cover of a folder issued by Ironton Bernhard Boiler Co., Ironton, O., and the caption is followed by "Bernhard Boilers Save at Both Ends—Why?" The text of the circular presents claims made for this cast-iron sectional boiler with sections extending from front to back of the boiler instead of in the conventional way. It is stated that the resistance through this boiler is a minimum, saving on stack requirement, and that, due to the low water-line made possible by the design, pits are unnecessary. It is stated that cold water in the boiler can be steamed in 10 minutes. The folder outlines the novel principles of design and construction and the cover, a facsimile of a blueprint, shows cross sections of a building and chimney for this type and for conventional types of boilers. These boilers are given the descriptive trade name Koolstack, and are manufactured in six sizes, rated from 550 sq. ft. to 2100 sq. ft. equivalent radiation capacity at boiler outlet. They are shipped in two sections to facilitate handling.

THE MASTER STOKER is the title of a circular recently issued by the Master Engineering Corp., New York, describing the low-pressure Master Stoker. This equipment has been in use on high-pressure installations for a number of years but has only recently been adapted to low-pressure work suitable for apartment houses, hotels, office buildings, etc. Fuel is fed into the hopper at the front of the boiler either by hand or by a conveyor, and is then automatically thrown evenly on to the entire grate area. The Master Stoker is controlled automatically between pressure limits, and motor blower unit is used in conjunction with it when necessary. Installation is simple as it is merely attached to the front of the boiler and requires no ash pit excavation or other boiler changes. The cheapest fuels are used and a saving in coal consumption is guaranteed.



The Master Stoker for Automatically Firing Small Boilers

GALLONS OF WATER PER HOUR TO BE HEATED 60° TO 180° FAHR.
SUGGESTED SIZE OF STEAM SUPPLY
STANDARD TANK SIZE
AMOUNT OF COIL SURFACE IN SQUARE FEET
IRON
BRASS
Powers
Hot Water
Tank Calculator
DIRECTIONS—Point Arrow A to gals. per Hr. wanted. Arrow B will then indicate sq. ft. of iron pipe, arrow C in brass pipe. Calculations are based on temperature rise of 120° with 5 lbs. steam pressure, controlled by a Powers Regulator. Omitting regulator reduces efficiency 20%.
Memo: 36' of 1" pipe or 28' of 1¼" pipe or 24' of 1½" pipe or 20' of 2" pipe = 1 sq. ft. heating surface
© 1927 T.P.R.CO.

Working Portion of the Hot Water Tank Calculator as Developed by Powers Regulator Company

LONG PIPE LINES WITH OXWELDED JOINTS entitles an interesting booklet from the Linde Air Products Co., New York. At the top of each page is a picturesque illustration showing how engineers in the gas and oil industries have attacked the problems of pipe joints in long pipe lines. It is here told how oxwelded lines have helped to overcome some of these difficulties. The artistic pictures make the book attractive. Size 6 in. x 9 in. Pp. 32.

HOW LOS ANGELES PROTECTS HER BATHERS is the subject of an interesting bulletin just published by Graver Corp., East Chicago, Ind. The Los Angeles municipal swimming pools, their construction and operation are described; a map shows the source of the city water supply, 250 miles from Los Angeles, while another shows the location of the pools in the city. Before the last season opened, all of these pools were equipped with Graver refiltering and circulating systems. The use of these systems during the year saved the city approximately 4½ million gallons of water per week, and, in addition, the pools were always clean and sanitary and the water well within the requirements set by the health authorities. Graver refiltering systems are described and illustrated, and useful general data are given. Size 8½ in. x 11 in. Pp. 16.

POWERS HOT WATER TANK CALCULATOR is an interesting device being sent out by The Powers Regulator Co., Chicago, in the shape of a rectangular sheet of cardboard 8½ in. x 11 in. with an eyelet for hanging. A rotating dial is fastened to the cardboard, and by rotating this in accordance with the instructions, determinations of heating surface in hot water heaters readily can be made. This device will be sent upon request.

NEW-TYPE H V FANS are featured in a well-bound catalog received from Clarage Fan Co., Kalamazoo, Mich. In the text this multiblade is described as having accurate proportioning of inlet, wheel and fan housing, insuring economy of operation by eliminating friction losses, eddy currents and other disturbances, which cause large power-requirements. Capacity tables, together with details of construction, and various pictorial views compose the book. Thirty-two pages are devoted to performance and dimension tables. Size 8½ in. x 11 in. Pp. 48.

HEATING HOMES THE MODERN WAY is the title on the cover of an attractively-printed and bound catalog received from the Petroleum Heat and Power Co., New York. In the text, the Petro oil burner is described, in its history and working, with two-tone color illustrations. At the end is a diagram of a complete Petro installation. Size 9 in. x 12 in. Pp. 20.

Oil Burners for Large Low-Pressure Heating Plants

Todd. *Rotating-Cup Atomizing Type, Manual Ignition*

1. Todd

"PRESENT Accepted Practice in Domestic Oil Burners" has filled a widespread demand for accurate and unvarnished data on this subject, as is evidenced by the fact that practically all surplus copies of THE HEATING AND VENTILATING MAGAZINE for the last two years have been sold. Beginning with this issue a new series will be presented, dealing with burners designed particularly to handle such heating loads as are found in schools, hotels, apartment houses, office buildings and factories. At the present time these burners are characterized by the absence of automatic controls, the Underwriters' regulations for their use requiring constant attendance.

AFTER an experience of nearly two decades in building oil-burning equipment, largely for marine types of boilers, the Todd Dry Dock Engineering and Repair Corp., Brooklyn, N. Y., entered the field of large low-pressure units used for heating hotels, apartment houses, office buildings and similar structures.

This class of installation is based upon entirely different factors from those controlling the domestic use of oil. The cost of available heat is the dominating factor and, as the small sizes of anthracite coal, stoker fired, offer formidable competition on this basis, it frequently is a case of close figuring to determine relative values of the two fuels.

By this token only the lowest grades of available oil fuel economically can be used, 14°-16° A.P.I. being somewhat a standard designation for this class of oil. Naturally this involves the preheating of the oil, reducing its viscosity for flow through the piping and, what is of prime importance, increasing the ease of atomization.

Having had a wide experience with power atomization through nozzles as well as with steam atomization, the Todd engineers determined upon the rotating cup atomizer as best adapted to the field in view. This was because of the excellent service reports on burners of this type that had been in service for a number of years.

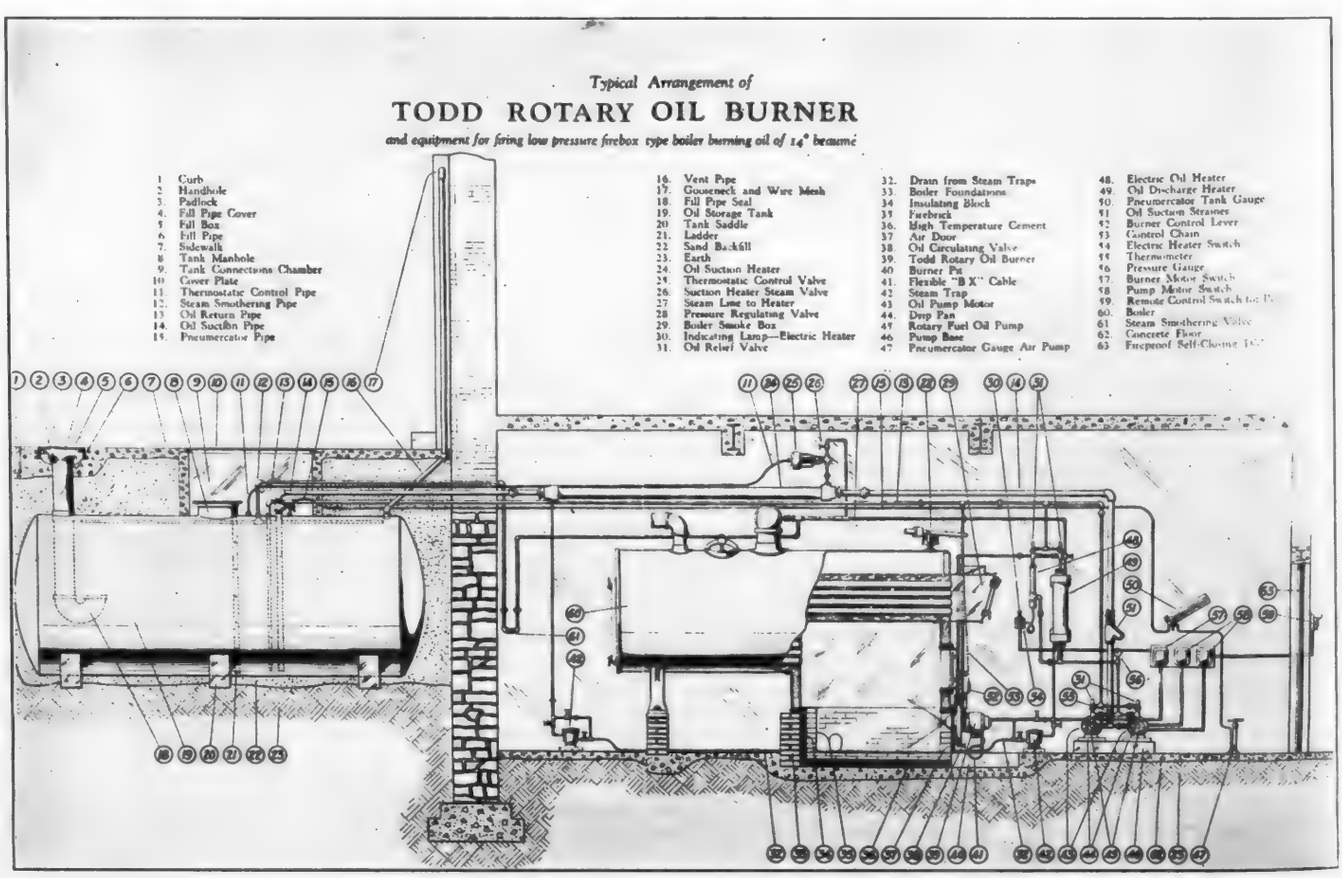
EQUIPMENT REQUIRED

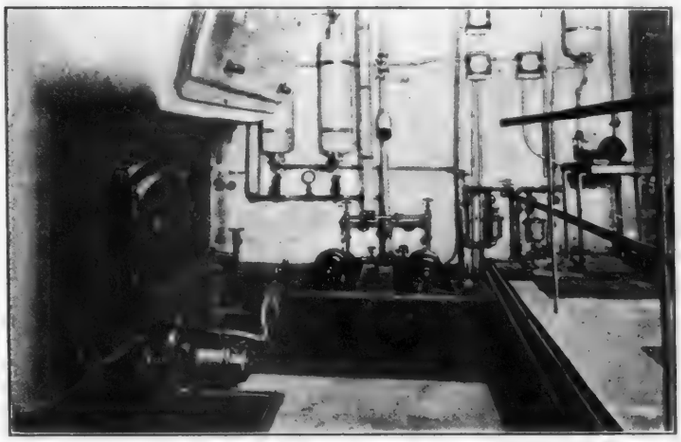
The burner unit, consisting of a revolving-cup atomizer direct driven by an electric motor (the common shaft also carrying the fan runner), is hinged on a front plate that takes the place of the ashpit door. The fuel is taken through a hollow trunnion. A separate motor-driven pump furnishes the oil at a pressure of 30-40 lbs. It is customary, on all except the smallest jobs, to install this pump unit in duplicate, but where more than one boiler is to be fired one pair of pumps of the proper size is sufficient.

Three oil heaters usually are installed —a small electric heater for starting and a service heater are interconnected in the oil pump discharge, the latter utilizing steam from the boiler. A concentric pipe heater is installed in the pump suction line, as close to the tank as possible.

This is designed to raise the temperature of the oil to about 100° F., and the heater on the other side of the pump is proportioned to add from 40° F. to 100° F. to that temperature, the degree of heating depending largely upon the oil used and local civic regulations. In some cases it is desirable to install a pipe coil heater in the fuel storage tank, especially if it is so located as to absorb no heat from the building mass.

Each motor of the installation is controlled through an individual enclosed switch and a master switch located outside of the boiler room can be used in case of emergency. Other accessories





A Typical Todd Installation

are steam traps, thermostatic control for the suction oil heater, tank gage, strainers and pilot light for the electric heater.

THE BURNER UNIT

This type of Todd burner is built in three sizes, having motors of 1/3, 1/2 and 1 H.P., respectively, with corresponding maximum capacities of 100, 220 and 375 lbs. of oil per hour. There are two heavy-duty ball bearings on the motor shaft, the fan rotor and cup being carried on the inner overhanging end. Standard speed is 3,500 r.p.m. The rotor is a cast aluminum disc with radial ribs integral on one face. A steel plate covers the ribs. The air is delivered at the rim of the rotor and is turned, by the case, down and around the rotating cup. This fan supplies the primary air at pressures approximating 8 oz. per sq. inch. Between the motor and the fan casing is a cylindrical shutter controlling the air supply to the fan. This shutter, as well as a door opening admitting secondary air, is controlled by a linkage to a boiler-pressure diaphragm, to which the automatic oil-pressure regulator on the oil feed is also linked. Proper proportionate openings of the oil and air thus can be maintained.

Oil is delivered through the supply pipe, through a thermometer receptacle and pressure gage, past an automatic pressure-regulating valve and a hand-operated needle valve, down a radial passage cored in the burner casing and into a hollow bushing from where it is fed into the rear end, or bottom, of the rotating cup. In passing toward the front, or top, edge of the cup the oil is forced through openings in the cup spider which, it is stated, start breaking it up for easier atomization. The oil is then atomized from the sharp edge of the rotating cup.

Lubrication of the motor is provided by grease cups on each bearing.

Ignition is manual, a torch of asbestos wicking dipped into kerosene commonly being used.

As a protection against flooding of oil through ignition failure, a temperature-actuated chimney device may be installed, cutting off the burner and oil-pump motors if the stack temperature drops below a determined point.

Standard fuel-storage tanks vary between 5000 and 1000 gal., depending upon local conditions.

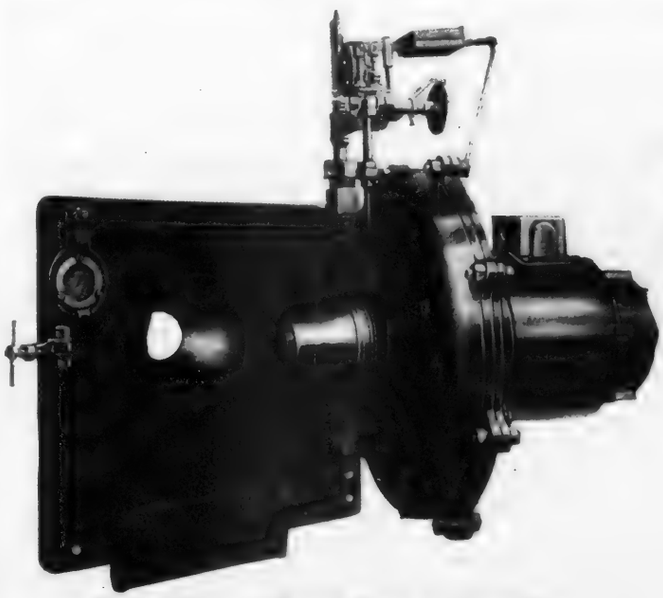
BRICKING

It being necessary to provide a definite combustion chamber for each type of boiler that is found, bricking will vary. The general principles are fixed: To provide a fire-box as large as possible, of such shape as to insure complete combustion without impingement of flame on boiler surfaces, and to afford every opportunity for a maximum production and absorption of radiant heat.

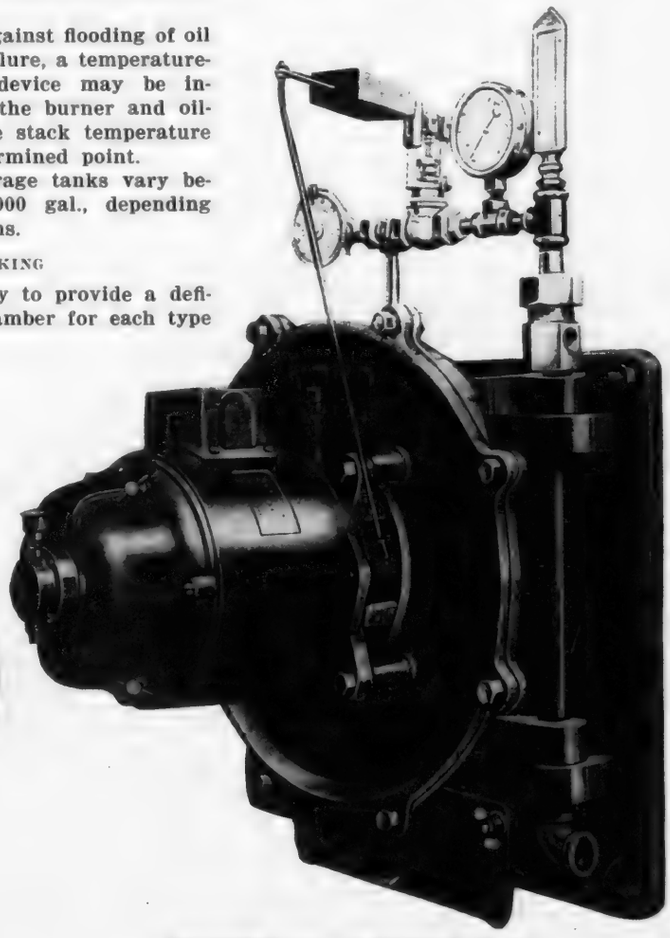
The Todd rotary burner is designed to burn oil fuel not heavier than 14° A.P.I.

Dedication of Crane Memorial in Chicago

A carillon of 43 bells and a carillon tower, given to St. Chrysostom's Church, Chicago, by R. T. Crane, Jr., in memory of his father, Richard Teller Crane, founder of the Crane Company, and of his mother, Mary Prentice Crane, were dedicated May 15. The bells were cast in England and have a total weight of 30,692 lbs. Inscribed on the bells is the following: "I sing of eternity, I fill the earth with a gladsome song, I soothe the troubled spirit. In memoriam. Richard Teller Crane, brass and bell founder, 1832-1912. This carillon is given by his son, R. T. Crane, Jr., 1926," and "Sing of eternal love of motherhood, of a son's remembrance. In loving memory of Mary Prentice Crane, 1835-1885. Placed in this carillon by her son, R. T. Crane, Jr."



Todd Oil Burner Swung Open for Inspection



Todd Oil Burner in Firing Position

When Oil Burners Are Sold

THE graph presented below was compiled from data received from twenty of the leading oil-burner manufacturers, who furnished information for the article in THE HEATING AND VENTILATING MAGAZINE for April. The heavy lines on this graph enclose the field representing practically all of the returns made. It is interesting to note the rather extraordinary degree of uniformity, as shown here, in oil-burner sales from month to month. Each short horizontal line denotes the sales of one of these manufacturers, in per cent of his own total annual output sold in that particular month. One feature brought out by the graph is the almost uniform width of the field during the greater part of the year. The burners, for which data were supplied, are:

A. B. C., Aladdin, Aetna, Baker, Grant, Hardinge, Johnson, Kleen Heet, Marr, May, Nokol, Nu-Way, Oil-O-Matic, Petro, Rayfield, Socony, Sundstrand, Sword, Timken, and Wayne.

A series of diagrams (Fig. 2) shows the percentage of sales of important commodities, month by month, and is presented to indicate that the characteristic curve of oil-burner sales, at the bottom, does not depict a particularly bad condition of affairs. This curve of oil-burner sales was made from the reports of the above manufacturers.

The figures represent per cent of total annual sales. The oil-burner curve represents an analysis of sales of these manufacturers whose aggregate sales exceeded 60,000 burners.

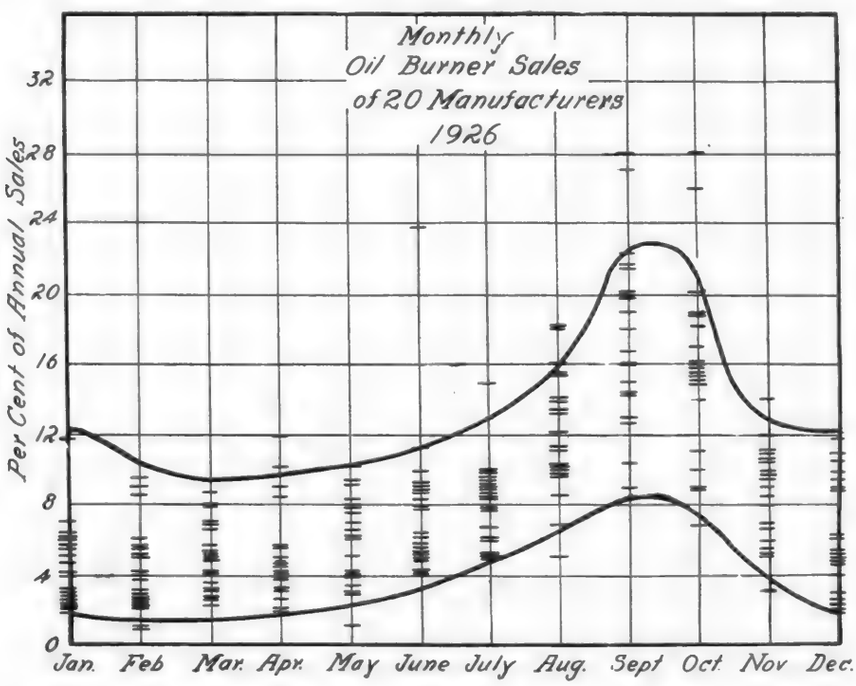


Fig. 1. Each Short Line Represents the Monthly Sales of an Oil-Burner Manufacturer, Expressed in Per Cent of His Total Annual Sales

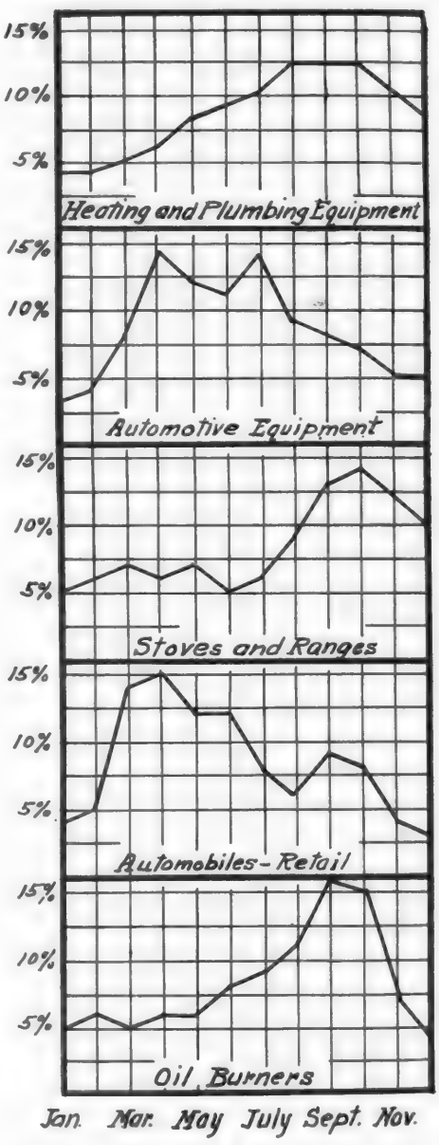


Fig. 2. Sales, Month by Month, of Oil Burners and Other Important Commodities

Margaret Ingels With New York Ventilation Commission

After having been closely identified with the detail involved in the study of air conditions as related to human comfort made at the Research Laboratory of the A. S. H. & V. E., at Pittsburgh, Miss Margaret Ingels has become identified with the New York Ventilation Commission, with headquarters in New York. Particularly because of her comprehensive grasp of this subject, and of her ability in general heating, ventilation and air - conditioning research, Miss Ingels should be a valuable asset to the staff of the commission in the extensive program it has mapped out for the immediate future.

Miss Ingels graduated from the University of Kentucky, completing the course in mechanical engineering, and for two years was with the Chicago Telephone Company. During the next four years she was associated with the engineering department of the Carrier Engineering Corporation, and in 1921 she accepted the call of her old mentor, Dean Anderson, and joined the staff of the Research Laboratory, of which the Dean was director.

Associated with O. W. Armspach, Miss Ingels delved into a study of the kata-thermometer and also assisted in the development of the Anderson-Armspach dust determinator. She also specialized in the infiltration studies that have occupied the Laboratory during the last few years. Miss Ingels is a full member of the A. S. H. & V. E., and, for some time, has been secretary of the Pittsburgh Chapter.

The New York Ventilation Commission is to be congratulated on securing the services of a research engineer with so valuable an experience in the particular field in which its investigations lie, and the many friends of Miss Ingels wish her continued and increasing success in her chosen work.

MEN CAN'T WORK IN GAS MASKS appears on a circular sent out by American Blower Co., Detroit, Mich., calling attention to the desirability for air changes in industrial enclosures where dust or gas-producing operations are in progress. The circular features a table showing frequency of air changes necessary for various applications.

AIR CONDITIONING

How to Use Moisture Regain Chart

Data Sheet No. 20-B shows the increase in moisture content of air supplied to theatres or other occupied spaces based on the number of occupants and the quantity of air handled. To find the increase in moisture content, locate the weight of air handled, on the lower horizontal scale. Pass vertically upward to the curved line indicating the number of occupants. From this point pass horizontally to the left and read the increase in grains of moisture.

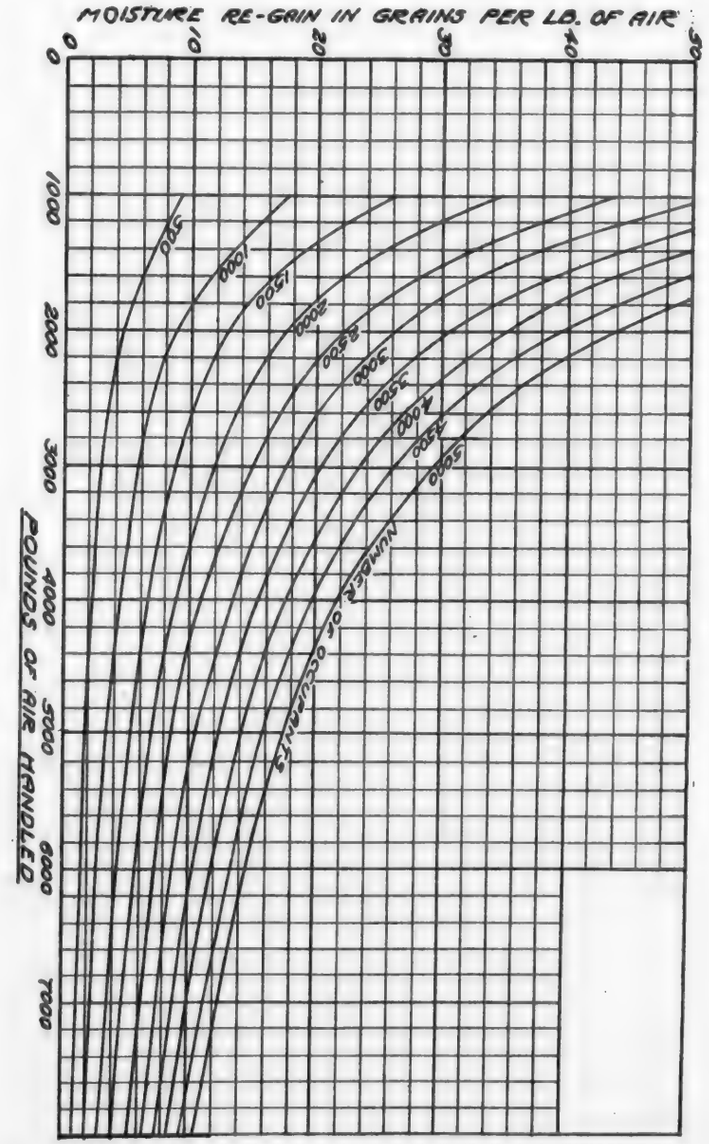
Example: Assume that 64,500 C.F.M., or 4800 lbs. of air per minute, are supplied to a 2500-seat theatre and determine the increase in dew-point and relative humidity due to the moisture given off by the occupants. Locate 4800 lbs. on the horizontal scale and pass vertically upward to the point of intersection with the 2500-occupant line. Then follow horizontally to the left vertical scale and read 9 grains of moisture per pound. Assuming that the dew-point temperature of the air at the inlet register was 57° F., then referring to a Psychrometric Chart it will be found that this is equivalent to a moisture content of 69.3 grains of moisture per pound of air. An increase of 9 grains gives 78.3, which is equal to a dew-point of approximately 60° F., an increase of 3°.

If the air in the theatre is to be maintained at 75° F. dry-bulb and a relative humidity of 60%, corresponding to a dew-point of 60° F., then the dew-point at the cooler outlet must be 3° lower, or 57° F.

O. W. Armspach.

AIR CONDITIONING—How to Use Moisture Regain Chart | No. 20-C

AIR CONDITIONING



AIR CONDITIONING—Moisture Regain | No. 20-B

Present Accepted Practice in Domestic Oil Burners

Aladdin. *Air Atomizing, Mechanical Draft, Gas Ignition*

Previous articles in this series are:

1. *Kleen Heet*, July, 1925.
2. *Baker, July*, 1925.
3. *Kerrihard, July*, 1925.
4. *Silent Glow, August*, 1925.
5. *Aetna, August*, 1925.
6. *Caloroil, September*, 1925.
7. *Oil-O-Matic, September*, 1925.
8. *Chalmers, October*, 1925.
9. *Hart, October*, 1925.
10. *Sun, October*, 1925.
11. *Rayfield, November*, 1925.
12. *A. B. C., November*, 1925.
13. *Electrol, December*, 1925.
14. *Grant, January*, 1926.
15. *Nu-Way, January*, 1926.
16. *Wayne, February*, 1926.
17. *May, February*, 1926.
18. *Ray Rotary, March*, 1926.
19. *Super Oil Heator, May*, 1926.
20. *Nokol, July*, 1926.
21. *Johnson, August*, 1926.
22. *Arrow, September*, 1926.
23. *Safe Fire, October*, 1926.
24. *Sword, November*, 1926.
25. *Hardinge, January*, 1927.
26. *Petro, February*, 1927.
27. *Sundstrand, March*, 1927.
28. *Northern, May*, 1927.
29. *Vesta, June*, 1927.
30. *Marr, July*, 1927.

31. Aladdin

ALADDIN oil burners are designed for application to heating boilers carrying net loads of 4000 sq. ft. steam radiation or less, and are manufactured and marketed by the Aladdin Utilities Corp., Chicago.

These burners are built in three sizes, or models, the smallest of which, Model K, is of the so-called "down-draft" type, the firing head being installed through the fire door with the nozzle over the centre of the grate, projecting the flame-jet downward onto the refractory-covered grate. This type is said to be particularly adapted to the round boilers and small square sectional types so common in small homes.

Models G and H fire horizontally through the ash-pit door, into refractory chambers built to give the best results in each particular case.

HOW ATOMIZATION IS ACCOMPLISHED

The nozzle is constructed of phosphor bronze and consists of a housing within which is a nozzle pin, adjustable and locked when in the desired position. This pin is hollow and closed at the firing end, which is rounded. Two orifices are drilled into the hollow section, at right angles to the axis, just back from the rounded end. This tube carries the oil to the front end of the nozzle assembly, ejecting it, due to pump pressure, in two fine streams at right angles to the tube.

The nozzle head is a cap-like piece, recessed from the rear, having internal threads into which the nozzle-pin screws, with the rounded tip located just inside a large orifice in the outer face of the head. By means of the screw threads the location of the nozzle-pin head (and the oil orifices), with reference to the orifice in the nozzle head, is determined and set. Air enters a cored recess in the nozzle housing surrounding the nozzle pin, and passes through tangentially-drilled holes in the head, being compressed by the restriction offered by the annular hole at the end of the nozzle pin. The Venturi effect thus obtained atomizes the oil and delivers the oil-spray and primary air well mixed.

An extremely quiet flame results from retarded combustion, secured through the manner in which secondary air is admitted through the ash pit.

Two Model H Aladdin Oil Burners In a Typical Installation.

THE POWER UNIT

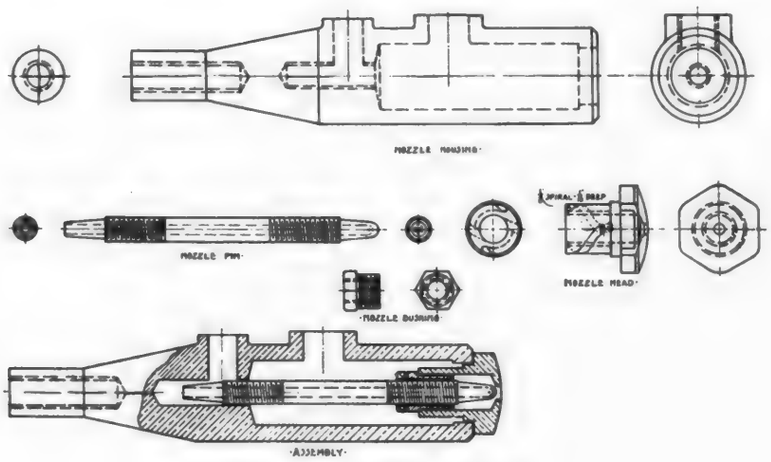
All models have similar power units, the motor being of the slow-speed type, ranging from 1/6 to 1/4 H.P. Motors of the repulsion-induction type insure freedom from radio interference. The

Installation of Model K Aladdin Oil Burner

oil pump and air compressor are direct driven by the motor, and an oil pump in the base of the unit assembly supplies lubrication to bearings and compressor blades through a pressure-feed system. The base is set on adjustable legs so that proper blast-tube alignment can be secured in any boiler.

FAN AND PUMP DETAILS

Blades of cast aluminum are so mounted as to minimize vibration; no butterfly adjustment is used, air volume being controlled through adjustable shutters in the air intake. The air compressor is of the twin-blade rotary type, with bearings the full width of the rotor blades. Blades are set on an angle, and from 4 to 10 lbs. pressure can be built up without chattering. In practice, however, from ½ to 3 lbs. only are required. A Yoke-type oil pump, with a capacity ten times the maximum ability of the burner, is used. A gland of special design is guaranteed leakless.



Details of the Aladdin Nozzle

NON-PULSATING BACK-PRESSURE VALVE

Oil not required by the burner is bypassed to the tank through a valve designed to prevent pulsations in the oil pressure when it is operating. A positive cut-off valve, operating through a sylphon bellows, prevents oil from reaching the nozzle except when the required pressure has been attained. The slowing down of the motor reduces the pressure and causes this valve to function even before the motor stops.

CONTROLS

Mercoid controls are used on all models with an extremely simple series wiring diagram. The new Visa-flame-operated safety is used on models G and H. Failure of the flame to become established, excess temperature in the boiler water or of air in the control room—any of these will open the motor circuit. Ignition is by means of a Bunsen gas-burner, constantly operating. It is stated that the low gas consumption—1000 to 1500 cu. ft. per month—is not objectionable, and the simplicity of the ignition scheme is apparent.

The Aladdin burner is listed by the Underwriters to burn oil not heavier than 28° A.P.I.

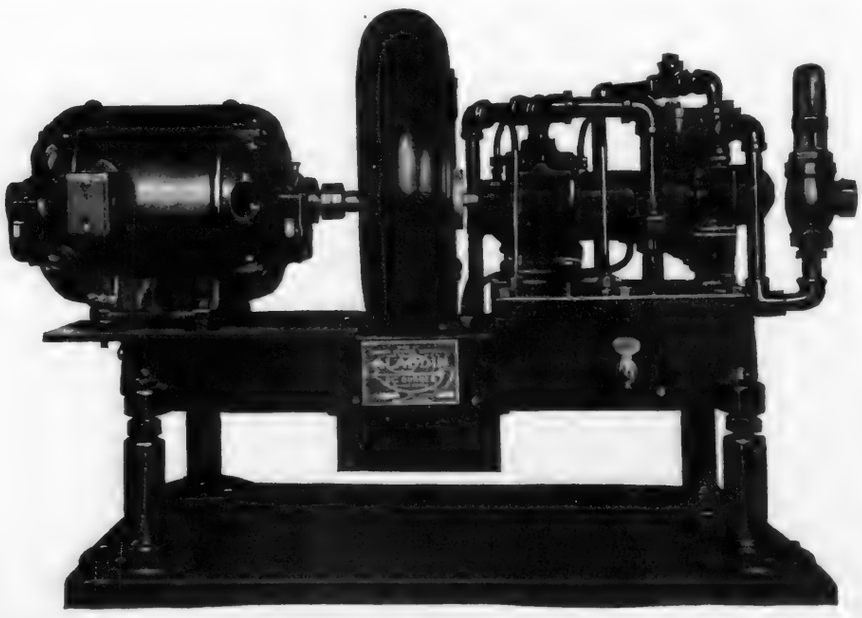
Is Window Glass Doomed?

The Council on Physical Therapy of the American Medical Association has concluded a preliminary series of tests to determine the efficiency of certain window-glass substitutes in transmitting the antirachitic rays of sunlight. Tests were made of the transmission of ultra-violet rays, the determination being made by spectroscopic analysis, and by the biological effects of transmitted sunlight. Various material having such characteristic trade names as, Vitaglass, Cel-O-Glass, and Flex-O-Glass, were used.

"The results of these investigations encourage the belief that there are now available materials for glazing our windows which do not possess the fault of window glass in excluding the health giving rays of sunlight. This belief is particularly engendered because the cages did not have a southern exposure and, moreover, they were of such size that the chickens were not compelled to remain in the sunlight area. A comparatively small amount of exposure to sunlight, even during the winter months, at the latitude of Boston, has a decidedly beneficial effect.

"Corning glass and the clear Vitaglass are as transparent to the visible rays as is window glass. Vitaglass is furnished also in a translucent ('Cathedral') form, which is particularly suitable where privacy is desired. Cel-O-Glass and Flex-O-Glass are not transparent, but the data presented show their comparative value for use in solariums and for animal husbandry in cases in which transparency is not essential. Both of these substances are less expensive than ordinary window glass, but the Flex-O-Glass does not withstand the onslaught of the weather as well as does the Cel-O-Glass. The waxy coating of the Flex-O-Glass has a tendency to soften in hot sunshine and dust may then adhere which is not easily washed off. This material is primarily intended, however, for use in animal husbandry to provide protection in winter. During the hot summer months it may be removed and in the fall reinstalled."

—From the Journal of the American Medical Association.



Power Unit of Aladdin Oil Burners

Deaths

FRANK W. TERRY of the Richmond Radiator Co., New York, died July 7, as the result of an automobile accident.

H. P. CAHILL, president and founder of the H. P. Cahill Plumbing and Heating Co., Akron, O., died at the People's Hospital in that city, June 12, after a short illness. Mr. Cahill was a past president of the Ohio Master Plumbers' Association and of the Akron Master Plumbers' Association.

C. C. PYKE, president of the Indiana Society of Sanitary Engineers, and one of the founders of the Lane-Pyke-Werkhoff Co., Lafayette, Ind., died June 12, following an operation. Mr. Pyke was born in Lafayette, December 9, 1855.

DR. WILLIAM P. GERHARD, a well-known sanitary engineer and a writer on sanitation subjects, died at his home, Scarsdale, N. Y., July 8. He was 72 years old.

WILLIAM J. CARLIN, for the past 20 years president and treasurer of the Coffin Valve Co., Dorchester, Mass., died July 19, in his sixtieth year, at his summer home on Little's Point, Swampscott, Mass., after a short illness.

TYPE ME FAN

Realizing that the success of heating, ventilating, and air conditioning systems depends on the fan for economical and positive operation, Architects and Engineers specify the ME Fan outright.

Certified Performance *is an Insurance Policy of Satisfaction*

SPECIFYING a Type ME Fan removes all uncertainty in ratings—for this fan has been *authoritatively* tested and certified in the laboratories of two large Universities.

Lower RPM and tip speed for a given pressure, higher total and static efficiency, greater economy, and quietness heretofore unknown are the engineering achievements of the ME Fan. And its craftsmanship dignifies its leadership.

It is to your advantage to investigate the ME Fan. It is the culmination of over forty years experience and progress in designing and manufacturing air moving apparatus.

Complete description with engineering data is contained in Catalog No. 100, with interesting information covering the tests made in two Universities. A postal card will bring your copy by return mail.

Representatives in Principal Cities

Fans
Unit Heaters
Air Washers
Blowers
Furnaces

NEW YORK BLOWER COMPANY

General Offices
2242
South Halsted
Chicago

HEAT *and* VENTILATE MECHANICALLY—USE ME FANS *for* BEST RESULTS

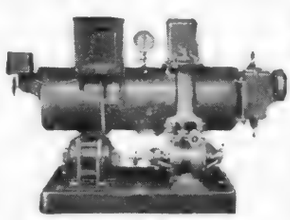
TABLE OF CAPACITIES OF STANDARD JENNINGS HEATING PUMPS

Size	Equivalent Direct Radiation sq. ft.	Water Capacity At 180° F Against 10 lbs. Pressure gal. per min.	Size	Equivalent Direct Radiation sq. ft.	Water Capacity At 180° F Against 10 lbs. Pressure gal. per min.
T	2,500	4	D	40,000	60
M	5,000	8	E	65,000	90
A	8,000	11	F	100,000	140
B	16,000	22	G	150,000	200
C	26,000	35	H	300,000	400

Jennings water capacity *double* normal condensate

In calculating the normal condensation in a steam heating system, liberal practice allows ⅓ lb. of condensate per hr. per sq. ft. of equivalent direct radiation. This not only takes care of the condensation within the radiation itself, but also provides for that which occurs in the supply mains.

So that for, say, 26,000 sq. ft. radiation, the normal quantity of water to be removed is 26,000 x ⅓ =8,666 lbs. per hour. Or 17.4 gallons per minute.



The water capacity of the Jennings Pump is just *twice* this amount. As the table shows, the size C unit can be relied on to handle 35 gal. per min.,—that is, double the condensation normally produced by 26,000 sq. ft. radiation for which the C pump is recommended.

The same method of rating is applied to the other Jennings sizes. Providing a factor of safety that is more than adequate to take care of unusual peak loads.

NASH ENGINEERING COMPANY

81 Wilson Road SO. NORWALK, CONN.

Branch Sales Offices: Atlanta, Birmingham, Boston, Buffalo, Chattanooga, Chicago, Cleveland, Dallas, Denver, Detroit, Indianapolis, Kansas City, Memphis, Miami, Minneapolis, New Orleans, New York, Omaha, Philadelphia, Pittsburgh, Portland, Richmond, St. Louis, Salt Lake City, San Francisco, Seattle, Tampa, Washington, D. C. In Canada: Montreal, Toronto and Vancouver. European Offices: London, Eng., Norman Eng. Co.; Brussels, Belgium, and Amsterdam, Holland, Louis Reijners & Co.; Oslo, Norway, and Stockholm, Sweden, Lorentzen & Wettre.

Jennings Pumps

RETURN LINE AND AIR LINE VACUUM PUMPS CONDENSATION AND CIRCULATING PUMPS

Trade and Miscellaneous Notes

Coming Events

September 19-23, 1927. Fall meeting of the American Welding Society at Detroit, Mich. Headquarters at the Book-Cadillac Hotel.

September 26-October 1, 1927. Eleventh Exposition of Chemical Industries at New York. Headquarters at Grand Central Palace.

October 12-16, 1927. Ninth annual convention of the American Gas Association at Chicago, Ill. Headquarters at the Hotel Stevens.

October 17-21, 1927. Fifty-sixth annual convention of the American Public Health Association at Cincinnati, O.

Miscellaneous Notes

Copper & Brass Research Association, 25 Broadway, New York, announces the opening of a mid-western office at 901 Landreth Bldg., St. Louis, Mo., under the direction of Harvey A. Call, who will co-operate with the trade in the Mississippi Valley in promoting the use of copper and its alloys, brass and bronze. Mr. Call was formerly associate editor of *Sheet Metal Worker*, New York.

National Brass Institute, an association of brass manufacturers, organized at the recent meeting of the National Pipe and Supplies Association, has elected the following officers: President, H. C. Bulkeley, American Sanitary Mfg. Co., Abingdon, Ill.; vice-president, R. L. Ottke, Standard Sanitary Mfg. Co., Pittsburgh; treasurer, E. M. Rogert, United-Oberndorf Corp., Cleveland; secretary, Charles M. Best, with offices at 229 Henry W. Oliver Bldg., Pittsburgh, Pa. The board of directors will consist of the elected officers as well as Earl W. Roberts, Roberts Brass Mfg. Co., Detroit, and E. H. Blywise, Republic Brass Mfg. Co., Cleveland.

National Trade Extension Bureau, at a special meeting held in Minneapolis, appointed Russell G. Creviston as secretary of a budget and program committee, which is composed of members of the manufacturers' and executive committees, and will assume the responsibility of carrying on the work of meeting the enlarged budget and developing a program for the bureau. William G. Bergner, secretary of the bureau, continues in that position in charge of the present activities.

Edwin H. Lockwood, formerly associate professor of mechanical engineering at the Sheffield Scientific School of Yale University, New Haven, Conn., has been promoted to full professorship.

Jiles W. Haney has been appointed chairman of the mechanical engineering department of the University of Nebraska, Lincoln, Neb.

Western Trade Golf Association, Chicago, held a joint tournament July 12, at the Olympia Fields Country Club. This was a get-together of this association, the Plumbing Contractors' Association of Chicago and the American Society of Heating and Ventilating Engineers.

Smoke Prevention Association, Inc., Chicago, announces the following new officers, elected at its recent convention in Des Moines: President, Andrew J. Glascott, chief smoke inspector, Buffalo; first vice-president, Thomas C. Casserly, research engineer, Weil-McLain Co., Michigan City, Ind.; second vice-president Arthur C. Stockwell, smoke inspector, New York Central Lines, Chicago; secretary-treasurer, F. A. Chambers, chief smoke inspector, Chicago.

Instant Heat—Always!

with

AUTOVENT

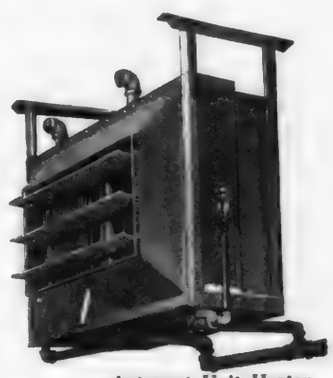
Guaranteed

UNIT HEATERS

Autovent Unit Heater
Floor Type

Here's Why

Heavy-duty motor . . . specially designed fan wheel . . . extra large size pressure chamber . . . tapered discharge . . . positively guaranteed performance . . . unusually careful and finished workmanship throughout . . . built for continuous duty.



Autovent Unit Heater
Ceiling Type

Unusual Record Established

IN the four years that we have been building Autovent Unit Heaters, *not a single one* has ever failed to give satisfactory service!

This is a great record of which we are justly proud. It fully convinces us that it pays in added friendship and goodwill to build our product *right*.

You will be figuring on many Unit Heater jobs this fall. Let us work with you. If you haven't our catalog and prices—write!

AUTOVENT FAN & BLOWER CO.

730-738 W. Monroe St., Chicago, Ill.

Westchester Oil Burner Association, New Rochelle, N. Y., which formerly has held semi-monthly luncheons, has organized formally with constitution and by-laws. Officers elected are: President, Vernon H. Holby, Aetna; vice-president, W. H. Brower, Sr., A.B.C.; treasurer, L. L. Halle, Westchester May; secretary, A. L. Kimball, Socony, 105 North Ave., New Rochelle, N. Y.

President Clarence M. Woolley, of the American Radiator Company, has been decorated by the Belgian Government with the medal of "Officer of the Crown." The decoration was conferred by Baron de Cartier de Marchienne, Belgian Ambassador to the United States.

National Association of Master Plumbers has established official headquarters for the ensuing year in Albany, N. Y., at 9-10 Albany County Savings Bank Bldg., South Pearl and State Streets. Albany is the home city of President Thomas F. Nolan.

Pierce, Butler & Pierce Not in Boiler Merger

In view of published reports, the Pierce, Butler & Pierce Mfg. Corp., New York, announces that it has made no agreement for merger with any other company or companies and has under consideration no change whatever in its present policy.

General Sales Offices of American Radiator Company Move to New York

Effective July 15, the general sales offices of the American Radiator Company, formerly located in Buffalo, N. Y., were established in New York in the American Radiator Building, 41 West 40th Street.

R. B. Flershem, formerly general sales manager of the company, has resigned but will continue to act in an advisory capacity with the title of consulting vice-president. Joseph Beirn, formerly district sales manager, has been appointed general sales manager, with headquarters in New York. It is also announced that W. M. Scudder, vice-president in charge of sales, will be located in the Chicago district office.

Chicago Distributing Organization for Aladdin Oil Burners

James L. L. McCormack, formerly vice-president and secretary of Hardinge Bros., Inc., has taken over the distribution of Aladdin oil burners for Chicago and the suburban district. Mr. McCormack is well-known in the trade, having been active in a sales and executive capacity since the inception of the oil-burner industry.

Aladdin engineers have recently made some refinements, such as the secondary application of volume air in the model K down draft and the addition of the latest Mercoid safety controls. The Chicago distributing organization will be known as the Aladdin Oil Burner Sales.

Manufacturers' Notes

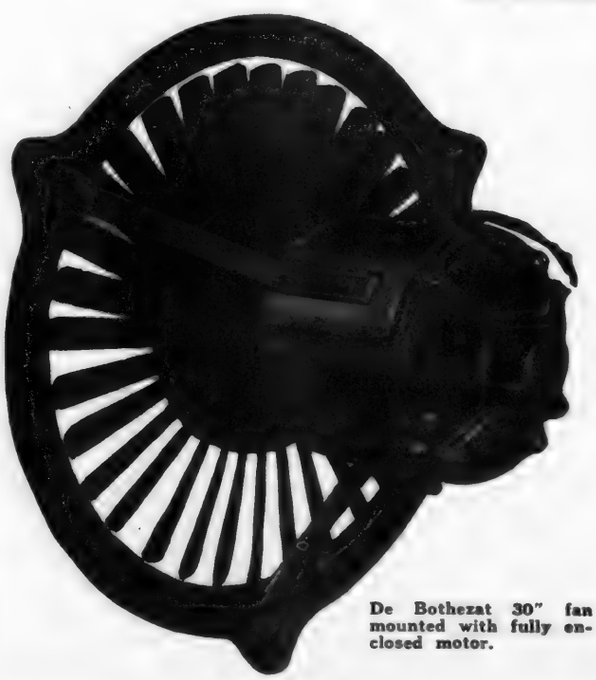
Autovent Fan & Blower Co., Chicago, Ill., announces that Terry-Durin Co., Cedar Rapids, Iowa, has been appointed distributor in the Iowa territory.

Ingersoll-Rand Co., 11 Broadway, New York, has opened a branch office at 236 High St., Newark, N. J., to provide better sales and service facilities in northern New Jersey and adjacent counties of New York state. F. K. Armstrong, formerly with the company's New York sales branch, has been appointed manager.

Graver Corp., East Chicago, Ind., announces that at an election held on June 17, the following officers were elected: President and treasurer, W. F. Graver; first vice-president, P. S. Graver; second vice-president, J. P. Graver; third vice-president, K. W. Bartlett; secretary, H. S. Graver; assistant secretary, A. E. Lucius.

Why are De Bothezat Disc Pressure Fans Unsurpassed for Positive Ventilation?

Because—

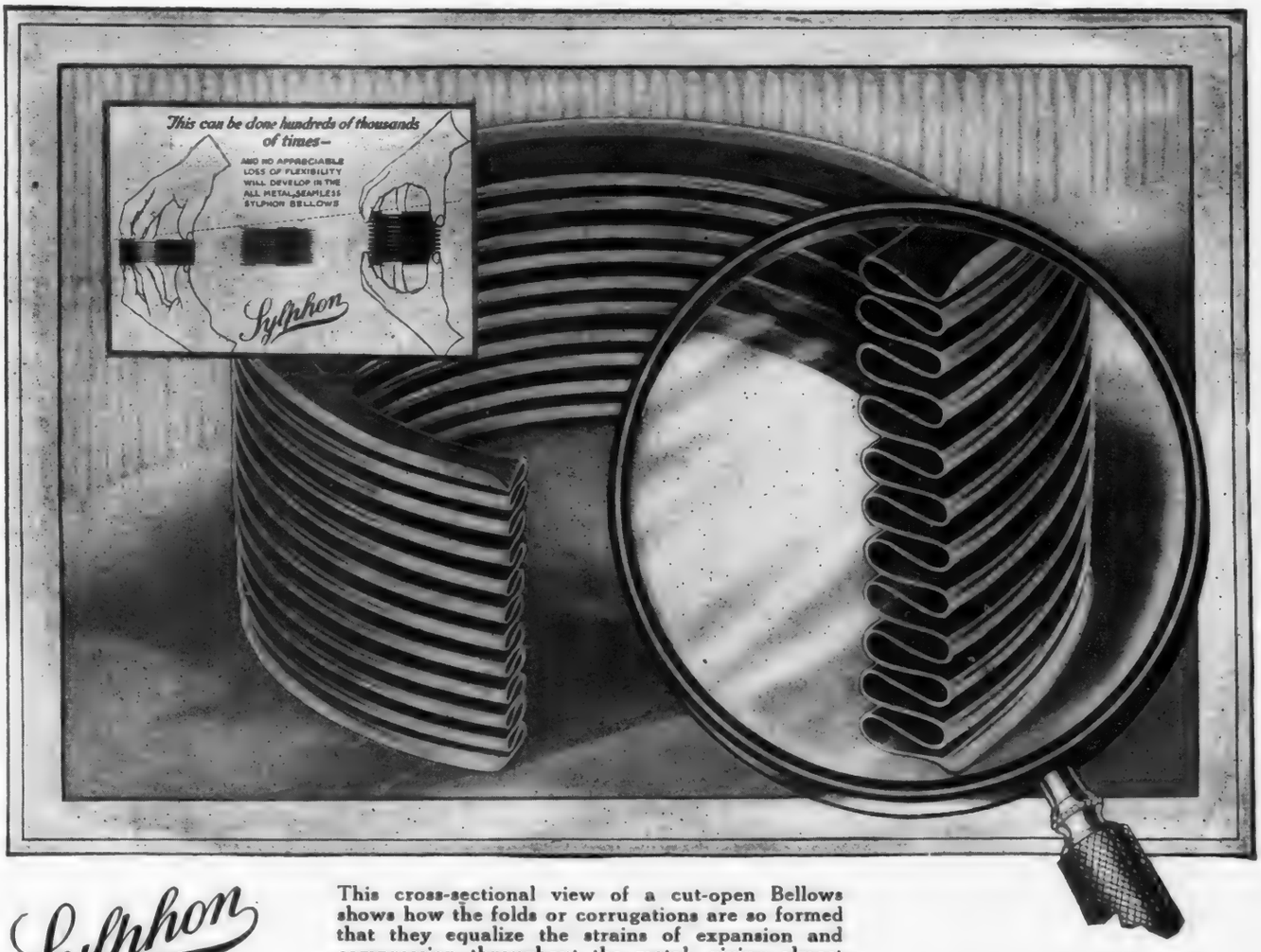


De Bothezat 30" fan mounted with fully enclosed motor.

1. Build up Static Pressure.
2. Overcome duct resistance.
3. Highly efficient.
4. Reliable and Flexible.
5. Give Positive Results.
6. Perfectly Balanced.
7. Rigid Construction.
8. Scientifically Designed.
9. Reliable.
10. Powerful Exhaust of Fumes.
11. Powerful Removal of Vapors.
12. Powerful Exhaust and Ventilating Against Wind.
13. Powerful Supply of Air.
14. Low Installation Cost.
15. Economical Installation and Operation.

Write for Catalog H V

De Bothezat Impeller Co.
Incorporated
1922 Park Ave., New York City


This can be done hundreds of thousands of times—
AND NO APPRECIABLE LOSS OF FLEXIBILITY WILL DEVELOP IN THE ALL METAL SEAMLESS SYLPHON BELLOWS
Sylphon

Sylphon

This cross-sectional view of a cut-open Bellows shows how the folds or corrugations are so formed that they equalize the strains of expansion and compression throughout the metal, giving almost indefinite life to the Bellows.

Steam Damper Regulators

FOR LOW PRESSURE STEAM BOILERS

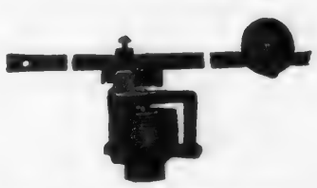
NOTE the construction of the Sylphon Bellows—the diaphragm of all genuine Sylphon Damper Regulators. The *seamless, all-metal construction* makes the Sylphon Bellows the most sensitive, flexible and durable diaphragm in existence.

The service and life of any damper regulator depend completely on the diaphragm.

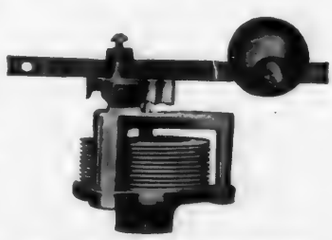
If the diaphragm doesn't stand up, the regulator cannot continue in operation. Rubber rots. Solder cracks. Diaphragms made of these or other perishable materials, as you know, are not capable of responding continuously through years of service to the expansions and contractions of varying steam pressures.

The Sylphon Bellows is a seamless, solderless, all-metal diaphragm. It is sensitive, smooth and positive in action, responding to the slightest changes in steam pressure. It opens and closes the draft dampers smoothly and dependably year after year. There is no servicing of a genuine Sylphon Damper Regulator.

Insist on the genuine. ***Refuse imitations.*** ***Ask for Bulletin WDR-5***



No. 22-J Sylphon Damper Regulator for low pressure steam boilers with light dampers.



No. 22 Sylphon Damper Regulator for low pressure steam boilers.

No. 924 Sylphon Steam Damper Regulator, extra sensitive type.

The Fulton Sylphon Company

Originators and Patentees of the Sylphon Bellows

Knoxville, Tennessee, U.S.A.

SALES OFFICES IN: New York Chicago Detroit Boston Philadelphia and all the Principal Cities in the U. S.

European Representatives: Crosby Valve & Engineering Co., Ltd., 41-42 Foley Street, London, W. 1, England

Canadian Representatives: Darling Bros., Ltd., 120 Prince Street, Montreal, Canada

Stanley Sales Co., 1440 Broadway, New York, agents for the American District Steam Co., North Tonawanda, N. Y., announces the appointment of Henry P. Kahn as its representative. Mr. Kahn will assist George S. Whiffen, head of the Stanley company.

Kieley & Mueller, Inc., 34 West 13th St., New York, announces that the company is now represented in the New England territory by Ray Engineering Co., of Boston. Another appointment is that of the Fulton Engineering Co., Los Angeles, as representative on the Pacific Coast for the company's line of steam, water and air specialties.

Bonney Forge & Tool Works, Allentown, Pa., has appointed W. W. Wixson, who has been connected with the company for a number of years, as district sales manager of the central district.

C. A. Dunham Co., Ltd., Toronto, Canada, announces that Fred W. Spencer, until recently with McKellar & Blackhall, Toronto, has been appointed sales manager of the company's branch at Halifax, N. S.

Larimer-Lauer, Inc., 1824 S. Hope St., Los Angeles, Calif., announces that the entire stock of George B. Larimer, one of the members of the firm, has been purchased by Harrold English and Harold E. Lauer. Mr. Larimer is retiring from business.

Johns-Manville Corp., 292 Madison Ave., New York, announces the election of Theodore F. Merseles as president. H. E. Manville, who has been president of the company since the death of his brother, T. F. Manville, in 1925, has been elected chairman of the board of directors. Mr. Merseles, who retires from the presidency of Montgomery Ward & Company, will continue as a director of that company and as chairman of its executive committee.

Theodore F. Merseles
President, Johns-Manville Corporation

Walsh and Weidner Boiler Co., New York, announces the appointment of J. Gould Coutant as advisor to manufacturers of fuel-burning equipment, air heaters, economizers, etc.

Robinson Furnace Co., 205 West Lake St., Chicago, has acquired the Heating Systems and Supply Company, which in the future will be known as the Heating Systems Division of the Robinson Furnace Company.

Lincoln Electric Co., Cleveland, O., announces that the Missouri district office has been moved from 1808 Railway Exchange Bldg., St. Louis, to 1003 Davidson Bldg., Kansas City, with Robert Notvest in charge. A branch office has been established by the company at 220 Nicholas Bldg., Toledo, O., with A. H. Homrighaus, formerly in charge of the Missouri district, as manager of this district.

Evins F. Glore & Son, Inc., New York, have opened a warehouse in Asbury Park, N. J., at Third and Railroad Aves., where they will carry a line of boilers, radiators and tank heaters. Samuel Barnes is manager of the branch.

Rome Brass Radiator Corp., 1 East 42nd St., New York, announces the appointment of Thomas E. Crone as district manager of the company with headquarters in New York. Mr. Crone was formerly district sales manager of W. A. Russell & Company.

Changes of Address

Rome Brass Radiator Corp., 1 East 42nd St., New York, announces that its Chicago office has moved to Room 1922, 228 North La Salle Street.

M. G. Harbula, consulting engineer, formerly of Chicago, is now located at 1564 Broadway, New York.

YEOMANS
YEOMANS PUMPS GIVE YEOMAN SERVICE
CONDENSATION PUMPS
AUTOMATIC ELECTRIC
NOISELESS RUGGED
The mark of Dependability
Built for all pressure and capacity requirements
Special bulletin giving sizes, dimensions and capacities with details sent on request.
Special Type H High Pressure Unit
YEOMANS BROTHERS CO.
1421 Dayton St. Representatives in all principal cities. Chicago, Ill.
DEPENDABILITY

"CHICAGO" Sure Return
The Small Condensation Pump With Many Big Features
"Sure Return" Condensation Pumps
CHICAGO PUMP CO.
24-Hour Delivery
High Quality—Low Price
Compact—Easy to Install
Automatic—Easy to Maintain
Sizes up to 10,000 Sq. Ft.—10 Lbs.
"Chicago" Condensation Pumps
For Any Size or Pressure
CHICAGO PUMP COMPANY
SEWAGE-CONDENSATION-CIRCULATING
BILGE-FIRE-HOUSE-VACUUM
2325 WOLFRAM ST. CHICAGO, ILL.

Jim: (who thinks all fittings are a gamble): "We've got to hurry to hook this line up by five o'clock. Hope we don't run into a lot of crooked threads."

Old Timer: "Don't worry! See the big 'G.'? Grinnell made these fittings."

The Old Timer Knows

Straight topping is one of many reasons why Grinnell Cast Iron Fittings mean better jobs with less labor. Grinnell Fittings make a straight, tight joint—without forcing. Insure perfect alignment. And cut down the delays and replacements resulting from sandholes. Try out these time-saving, labor-saving fittings. Write us for the name of the nearest distributor if your own jobber doesn't carry them. Address Grinnell Company, Inc., 208 W. Exchange St., Providence, R. I.

GRINNELL
PIPE FITTINGS

Cast Iron Fittings—Adjustable Pipe Hangers

GRINNELL

Pipe Bends—Welded Headers—Lap Joints—Piping Supplies

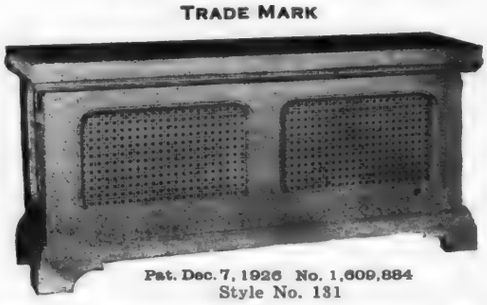
New Incorporations

Barber Gas Burner Sales Co., 1806 East 12th St., Cleveland, O., has been incorporated under the laws of the State of Ohio with a capital of $100,000. The company will distribute Barber patented gas burners and Minneapolis heat regulators, and will operate locally. Officers of the company, which is a subsidiary of the Cleveland Gas Burner and Appliance Company, are: President, Felix J. McTernan; vice-president and secretary, Ira E. Baker; treasurer, Harry E. Kerr. Frank Cotton, formerly manager house heating department of the Republic Light, Heat and Power Co., Buffalo, will have charge of the engineering department of the company, and the sales division will be under the supervision of Mr. McTernan, who will divide his time between his Buffalo office, where he has been located for the past six years as distributor of these products, and the Cleveland headquarters of the new company.

H. S. Kaiser Co., 31 West Kinzie St., Chicago, Ill., has been organized by Harry S. Kaiser, formerly associated with Hanley & Company. The new company will operate as ventilating and sheet-metal contracting engineers.

Edward R. Teller Co., 463-7 Broadway, Westwood, N. J., has been formed by Edward R. Teller, heating and ventilating engineer, who has resigned his position as sales manager of the Thatcher Company. Mr. Teller was connected with the Thatcher Company for 20 years. An office, warehouse and showrooms will be maintained at the above address. A request for catalogs from all manufacturers in the industry has been made by Mr. Teller.

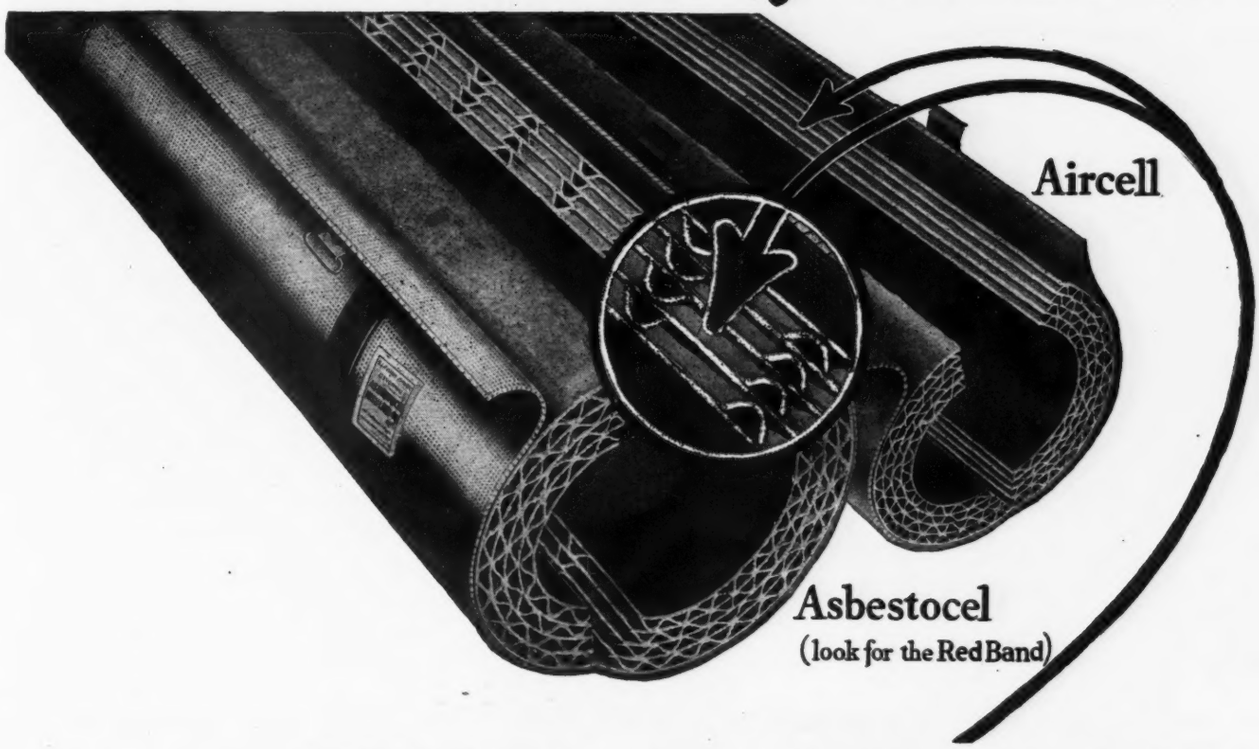
SEE OUR DETAILED DATA IN ASH&V.E. GUIDE
SEE OUR DETAILED DATA IN ASH&V.E. GUIDE
Boston Cleveland Chicago New York Philadelphia Los Angeles Kansas City

MAJESTIC
TRADE MARK

Pat. Dec. 7, 1926 No. 1,609,884
Style No. 131
Majestic Enclosures are built in all sizes and patterns. They are hygienically correct in design and properly direct a distribution of heat from the radiator.
Enclosure tops are of five-ply veneer of differently grained wood cemented together so that it will be unaffected by any change of temperature or moisture and will provide a strong window seat.
Majestic Enclosures are substantially fire-proof and are of particularly artistic design, lending an additional artistic touch to any apartment or room equipped with them. Write for descriptive circular and prices.
Majestic Cabinet Works, Inc.
Manufacturers of Patented Radiator Enclosures
1455 Park Avenue New York City
Telephone LEHIGH 0361

E Z
RADIATOR HANGER
We can ship from stock E-Z Hangers suitable for *All* makes of the new Tube Type Radiators.

Style R
HEALY-RUFF CO.
772 Hampden Avenue
ST. PAUL, MINN.

Over 20 times
the number of air-cells



TWENTY small closed cells are more efficient as a heating-pipe insulation than one large open cell.

Johns-Manville Improved Asbestocel has over twenty times the number of air cells per 3 foot section than an equal length of ordinary pipe covering. Cross corrugations running around the section break up the lengthwise corrugations into small, closed, isolated cells. In ordinary pipe covering the corrugations extend the entire length of the section and are open at the ends. Through them air may circulate freely.

Because of this greater number of small cells, Improved Asbestocel saves more heat and more coal. And it lasts longer because added corrugations give increased strength.

Specify Improved Asbestocel. You can always identify it by the red band at each end of every section.

JOHNS-MANVILLE CORPORATION, Madison Avenue at 41st St., New York
Branches in all large cities For Canada: Canadian Johns-Manville Co., Ltd., Toronto

Asbestos and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE
Improved
Asbestocel

House Heating with Oil Fuel

By P. E. FANSLER

Associate Editor, The Heating and Ventilating Magazine

Third Edition

THIS publication has been prepared for the use of the heating and ventilating engineer, the heating contractor, those engaged in the oil-burning industry, and the user and potential user of oil-burning equipment. Over a dozen beautiful and spectacular flame photographs were made particularly for this book in order that the subject of oil combustion might be more thoroughly presented.

Three chapters are devoted entirely to a discussion of the salient points of the outstanding oil burners that are on the market today. The chapter on efficiency clears up a great many points that are hazy in many minds. The chapter, "How Many Gallons of Oil Equal a Ton of Coal," and the chapter, "Checking the Radiation," will be of great value to those engaged in the sale or engineering phases of the industry.

I. The Era of Automatic Control.
II. The Use of Liquid Fuels for House Heating.
III. Oil Fuels—Definitions, Characteristics and Specifications.
IV. Oil Fuels—Source, Preparation and Distribution.
V. Combustion—Theory.
VI. Combustion—Practical Considerations.
VII. Boilers for Use with Oil Burners.
VIII. Boilers Particularly Adapted to Oil Burning.
IX. Warm-Air Furnaces for Use with Oil Burners.
X. Oil Burners—Types—Characteristics.
XI. Oil Burners—Atmospheric.
XII. Oil Burners—Mechanical Draft.
XIII. Oil Burners—Mechanical Draft.
XIV. The Control of Oil Burners.
XV. Accessories.
XVI. Tanks and Storage.
XVII. Efficiencies.
XVIII. Iso-Degree-Day Chart—Iso-Oil-Consumption Chart.
XIX. The Value of House Insulation.
XX. Selling Oil Burners.
XXI. How Many Gallons of Oil Equal a Ton of Coal?
XXII. Checking the Radiation.
XXIII. Checking the Heating-Plant Installation.
XXIV. Installing the Oil Burner.
XXV. The Underwriters' Regulations.
XXVI. Heating Service—Servicing Oil Burners.
XXVII. Buying an Oil Burner.
XXVIII. What the Underwriters' Listing Means.
XXIX. Oil Burners Listed by the Underwriters.
XXX. Oil Burner Ordinances.
XXXI. Oil Burner Fires.
XXXII. Bibliography.

362 PAGES - - - MORE THAN 150 ILLUSTRATIONS - - - PRICE $4.00

Published by

HEATING AND VENTILATING MAGAZINE CO.

1123 BROADWAY - - - - NEW YORK CITY

ANNOUNCING

The NEW VENTURAFIN

TRADE MARK

Junior

(SIZE NO. 2)

—a proved heating method of remarkable effectiveness—now extended to buildings of smaller areas.

Heretofore, because of its tremendous heating capacity, the Venturafin Method of Unit Heating was limited in application to large buildings.

Now, with the new Venturafin Junior, size No. 2, the remarkable advantages and economies of the Venturafin Method are extended to smaller structures.

Now, garages, stores, depots, small shops, showrooms, and buildings of similar types and sizes can have positive heat control, even distribution of heat, and more efficient heating equipment at materially lower costs.

Venturafin Junior, size No. 2, is not a new product—it is a new, smaller size of the famous Venturafin Unit that has given revolutionary heating results in over 15,000 installations.

Write now. Get all the facts on Venturafin before you install heating equipment in any building, large or small.

AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO
(652)

HEAT WITH UNIT HEATERS

American Blower

"Sirocco" TRADE MARK VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT

MANUFACTURERS OF ALL TYPES OF AIR HANDLING EQUIPMENT SINCE 1881

Ostrander Wins Suit for Recovery of Stock

After 11 years of litigation, a decision has been rendered by the Supreme Court of Missouri in the case of Lewis F. and Jenny L. Ostrander vs. Continental Brass and Foundry Company, Joseph Mesmer, Fred Mesmer, et al, in favor of the plaintiffs. The decision carries the payment by the defendants of a substantial sum to the Ostranders in addition to the payment of all costs. Lewis F. Ostrander, who was one of the plaintiffs, is vice-president and sales manager of the O-E Specialty Mfg. Co., of Milwaukee, Wis.

Central Station Heating Notes

London, Ont.—Application has been made for a Dominion charter by the Central Heating Co., London, with a capitalization of $350,000. This company is being formed here to carry on a heating business in the central portion of the city, and includes taking over the plants now operated by Helena Costume Company and Greene-Swift Company, Ltd. The Helena heating plant will be closed down and all steam will be supplied from the plant of Greene-Swift Company, which will be operated by the new company. It has been stated that $25,000 will be expended on improvements to the heating plant, including the installation of a new boiler and mains.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

MANUFACTURER'S REPRESENTATIVE—Manufacturer of complete line of fans, air washers and unit heaters, desires recognized representatives on commission basis. Address Box 81, care of Heating and Ventilating Magazine.

ESTIMATOR WANTED—An experienced estimator on heating, ventilating and power piping work. Preferably one familiar with New York City methods. State age and experience. Christian preferred. Permanent position if satisfactory. Address Box 82, care of Heating and Ventilating Magazine.

SALESMEN WANTED.—Experienced radiator and boiler salesmen for Brooklyn and Long Island. Please give previous experience in first letter. Union Radiator Co., Johnstown, Pa.

FOR SALE CHEAP

Indirect heating and ventilating equipment, including fans, engines, heaters, ducts, temperature control, etc. For full particulars write National Biscuit Company, Purchasing Department, 85 Ninth Avenue, New York City.

SHOP OWNERS ATTENTION!

Here is something new in the way of service to you. We have added a new facility that you can take advantage of—our

PRIVATE CONSULTATION SERVICE

—for a period of one year.

Business administration, management, better methods, technical problems, many phases of your own shop and its greater success are covered in the advice given you individually.

Write us for further information on this splendid, new service to help put your business on its feet at very reasonable cost.

St. Louis Technical Institute,
4543 Clayton Ave.,
St. Louis, Mo.

TWINFAN Unit Heaters

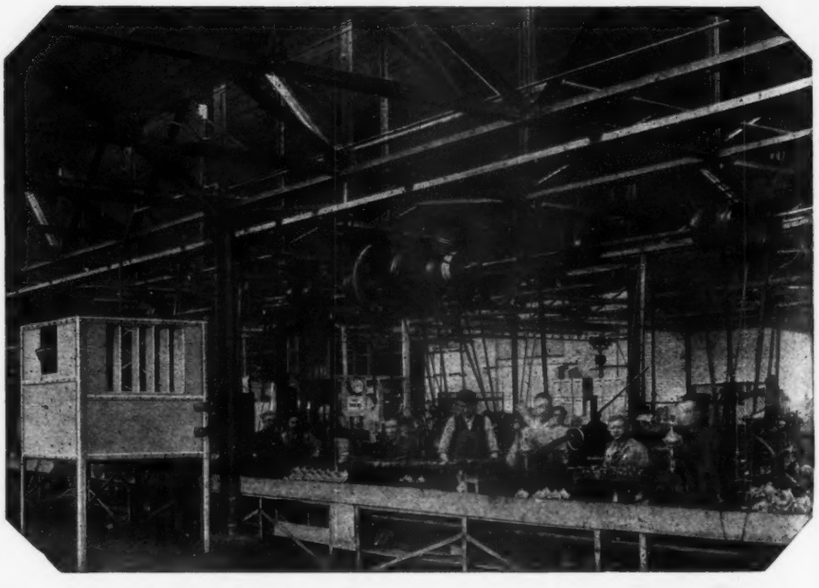
Economy *Plus* Comfort

IN winter, Dwyer TWINFAN Unit Heaters by their special indirect radiation system, keep the warmed air down to the level of the workers where it belongs; and away from the ceilings where it is wasted. That's why they effect tremendous savings in fuel.

In summer TWINFANS connected by ducts to the outside air furnish an adequate ventilating system that takes the discomfort out of hot, murky days.

And in fall and spring, TWINFANS make possible an immediate control of the heat by a turn of a switch. More than that, the heat may be turned on full in one part of a building and at the same time may be completely shut off from another part.

For a heating system that makes revolutionary reductions in heating costs, that saves floor space and provides a measure of comfort, that speeds up production and keeps workers contented, look up the records that are being made by TWINFANS in industrial plants and garages. Names and addresses on request.



You can build up a profitable REPEAT ORDER *business by selling TWINFANS to your customers. Our engineers will gladly help you on your next heating job.*

DWYER EQUIPMENT COMPANY
4534 W. NORTH AVE. CHICAGO, ILL.